THE
GRAPE CULTURIST

A TREATISE ON THE

CULTIVATION OF THE NATIVE GRAPE

BY

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PREFACE.

It is now thirty years since the first edition of this work was written and offered to the public, with many misgivings on the part of the author in regard to its reception and fate. But much to his surprise as well as gratification, it was cordially received, and the demand for frequent and large editions has continued down to the present time.

Now my publishers inform me that the original plates are worn out, by long and continued use, and that the book must be reset or relegated to that bourn, known to the trade as "out of print," and where so many of my worthy contemporaries have found a resting place during the past three decades of grape culture.

Many changes have occurred in this branch of horticulture during recent years, and valuable discoveries made in the way of materials and mode of applying to prevent the ravages of noxious insects and fungus diseases, all contributing more or less to advance the grape industry, which has now become one of great importance to the whole country. An immense number of new varieties have been produced, and yet some of those that were popular thirty-five years ago, still hold their own, and even lead in the markets of all our large villages and cities, and this, in my opinion, is a better test of their intrinsic value than all the encomiums bestowed upon them from other sources. Some of my earlier critics accused me of over-praising these varieties and neglecting those which they thought were more deserving of commendation; but all this has become history and no longer worthy of serious consideration.

My aim in writing this work was to make it an elementary text-book for the novice in grape culture, and not a scientific treatise—explaining the natural laws as I understand them—which govern the development and fruiting of the vine, believing that when the vineyardist comprehends these he may the more readily vary his operations, and yet do no violence to the fundamental principles of plant growth. To more fully carry out this idea, the "arm and spur system" of pruning and training was selected for illustrations, and these are retained, because it is the culmination and perfection of all systems, and has been attained through centuries of experience and numberless experiments in the Old World, and especially in France, where grape culture has long been regarded as one of the most important of her national industries.

It must be admitted, however, to fully carry out this system of pruning and training, a much greater amount of labor is required than in many others in vogue, but this cannot be urged as a fault of the system, but only an objection where labor is scarce and dear, and grapes as cheap as they have been with us of late years. But if the inexperienced vineyardist, and even those somewhat advanced, will study the principles involved in following this system to completion they will be all the better prepared for adopting any of the more simple forms of training given in the succeeding chapters.

The cultivation of our native grapes appears to have had its inception with a few amateurs like Tench Coxe of Philadelphia, and John Adlum of Washington, early in the present century, and from these localities, instead of extending southward, as might reasonably have been expected, it spread northward, and as an industry grape culture has reached its highest development on the banks of our larger rivers, smaller inland lakes, and on the south shores of the greater ones on our northern border. From there it has extended westward to the great plains beyond the Mississippi. It is scarcely probable, however, that the mild salubrious climate of the elevated regions of the Middle and Southern States are to remain almost unappropriated by vineyardists, and it is not improbable that in the near future the center of this great industry may be found several degrees south of its present locality.

Thirty years ago California was an unknown competitor in the fruit markets of the Atlantic States, but the completion of the then projected railroads across the continent has opened our doors to her products, and the mild climate of the State is so well adapted to the cultivation of the exotic grape in all its varieties, as well as other half-hardy fruits, that in her horticulture she is as much a foreign land as Spain, Southern Italy, and other semi-tropical countries of Europe. For this reason I do not refer to any of the grapes cultivated in that part of the country. In the classification of the American species of the grape the reader will notice that there has been a wide departure from the one given in the first edition of this work, and while botanical nomenclature and determination depends so largely upon the individual opinions of botanists, that there is little probability that they will ever reach an unquestioned conclusion, yet we may hope that each succeeding generation will strive to improve upon the labors of its immediate predecessor.

ANDREW S. FULLER,

Ridgewood, N. J., 1894.

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INTRODUCTION

To even attempt to write the history of the grape, one would need go back to the prehistoric races of the Eastern world, who have only left us silent relics of their handiwork, from which we may gather a misty idea of their domestic life and intelligence. The earliest rays of light which have come down to us, on this subject, are the ancient traditions, and these only take us back to the time when planting vineyards and grape culture had already become an important industry. But since those days the vine has been a constant attendant of civilization, following it from country to country, and progressing with it; yet the same species of the grape that thrives so well over a great portion of the Eastern Hemisphere has, with few exceptions, like that of California, entirely failed in this country. While we may regret that the exotic grape, in its many varieties, is not adapted to the climate of the Eastern States, yet we may congratulate ourselves upon having indigenous species, from which new varieties have been, and are still being, produced, which will rival, in point of richness and flavor, any of the foreign ones; and we are encouraged to hope for further improvements in the near future.

The cultivation of the vine in this country has had many obstacles to contend with. The earlier vineyardists, who had been accustomed to the improved grapes of Europe, could see nothing in the inferior wild grapes of this country to induce them to attempt their cultivation, and for many years all of our vineyards were planted with the foreign varieties, which, of course, failed; but the experiment was often repeated, but with no better results. Even so late as thirty years ago, and while writing the first edition of this work, a German acquaintance was planting fifty acres with foreign varieties on Long Island, insisting that all previous failures with these vines was due to want of proper pruning and training, and not, as claimed, to an uncongenial climate; but he had no better success than the hundreds of other enthusiasts who had previously entered the same field, only to retire with a certain amount of dear-bought experience. But after nearly, or quite, two centuries of such unsuccessful attempts to grow the European varieties of the grape in open culture in this country east of the Rocky Mountains, vineyardists turned their attention to the improvement of our native species, and the results are to be seen in the many excellent varieties now in cultivation. It is only since the foreign varieties have been discarded for the hitherto neglected native sorts, that grape culture in the East has become an important and established branch of American industry.

CHAPTER I.

BOTANICAL CHARACTERISTICS OF THE GRAPE.

The opinions of botanists differ widely in regard to the number of species of the grape indigenous to North America, and this is not at all strange, with a plant so disposed to run into varieties. In the earlier works of the late Professor Asa Gray,—and whose classification was followed in the first edition of the *Grape Culturist*, —he recognized only four species as inhabiting this country east of the Mississippi valley, and this limitation prompted me to remark, at that time, "that there are several native species which are found in certain sections of the country which are very puzzling, and one is at a loss as to which of the admitted species they should be referred." These varieties (or species), though growing indiscriminately with others, about which there is no doubt, seem to preserve their identity, and it is very difficult to decide whether to call them distinct species or marked varieties of the species enumerated by Dr. Gray. Practically it may be of little consequence what view is taken of these unusual forms, for the vineyardist is mainly interested in them as varieties, and it is of no particular moment to him whether we have one hundred, or only one native species, so long as there is a sufficient number to suit all soils and climates. But later, Dr. Gray and his eminent colleagues revised the list of native species of the grape, admitting that there were seven or eight indigenous species in the Eastern States, and two or more in the Pacific coast regions, only four of which, however, have given rise to valuable or promising cultivated varieties. This statement, in regard to "four species" only yielding promising cultivated varieties, must rest upon individual opinions as to the origin or descent of some of the recently produced varieties, but as it is of no great importance, we may leave it for future investigators to determine.

In giving a synopsis of the genera and classification of the grapes of the United States, I shall avail myself of a monograph prepared for the United States Department of Agriculture, by T. V. Munson, who has gathered together a mass of material heretofore scattered through the works of various botanists, and arranged it in a convenient order for study. This grouping of the species, or varieties, is probably as near correct as the present state of botanical investigation will permit, but I shall only give an epitome of his monograph, using such parts as appear to be of the most value and practical importance to the vineyardist.

Genus VITIS.—(Tournefort, Linnæus in part) Grape.

Calyx very short, or small; the border often obsolete, and the tube filled with the fleshy disk, which bears four or five thick caducous petals (Fig. 1 A greatly enlarged), cohering at the top, while they separate at the base, the corolla usually falling off without expanding; five thick glands, or lobes, of the disk, alternating with the stamens between them and the base of the ovary; flowers in a compound thyrsus, diœcious-polygamous in all the American species, mostly exhaling a fragrance like that of mignonette. Tendrils and flower-clusters opposite the leaves, the former almost always divided, or forked. Leaves simple, rounded and heart-shaped, often variously lobed.

FIG. 1.

GROUP 1. RIPARIÆ. (*River Grape.*)

Vine shrubby or climbing, moderately bark-shedding in fibrous plates; young canes cylindrical, or but slightly angled; smooth or tomentose; tendrils rather short and weak; leaves small to medium, broadly heart-shaped; clusters small, generally compact shouldered; fruit-stalk very short and thick; berries small to medium, with bloom vinous and without offensive odor.

Vitis rupestris, Scheele, Southwestern Texas, Ozark-Ridge; Central Tennessee.

Vitis riparia, Michaux, all Northern States and Canada east of Rocky Mountains.

Vitis Solonis, Hort. Berol., Northwestern Texas and New Mexico.

Vitis Doaniana, Munson, Northwestern Texas and New Mexico.

GROUP 2. WESTERN SPECIES.

Vine shrubby, as in *Vitis Arizonica*, or climbing vigorously, as in *V. Californica.* Young canes nearly cylindrical, tomentose, buds small to medium and whitish tomentose in expanding. Leaves long, cordate, or heart-shaped, small to medium silky tomentose to glabrous; clusters small to medium, mostly compact. Berries small black, with thin bloom, vinous, and hanging a long time to the vine. The foliage said to be very sensitive to mildew, and the fruit to rot. The *V. Californica* is the tenderest of all our native species, most abundant in light soils along streams.

Vitis Arizonica, Engelmann, var. *glabra*, Munson, Western Texas, New Mexico, Arizona, and Chihuahua, Mexico.

Vitis Girdiana, Munson, all California south of Mojave Desert, rare north of that.

Vitis Californica, Bentham, Central and Northern California, and Southern Oregon on Rogue River.

GROUP 3. CORIACEÆ.—(*Thick Leaved.*)

Vine rather slender, climbing, young leaves very small on end of growing shoots. Young annual canes white or rusty tomentose, except in *V. Champini.* Leaves medium, broadly cordate. Surface slightly rugose, dark green, thick, leathery. Young leaves at first pale pinkish underside, covered with whitish or rusty tomentose. Clusters small, loose, simply divided; berries medium to very large, without bloom; skin thick, more or less pungent, but not musky.

Vitis Champini, Planchon, Southwest Texas.
Vitis candicans, Engelmann, east of one hundredth meridian in Texas.
Vitis coriacea, Shuttleworth, Central and Southern Florida.

GROUP 4. LABRUSCÆ. (*Fox Grape.*)

Vine strong, stocky, climbing vigorously; tip of young shoots enveloped in rapidly growing and unfolding leaves, and usually of a pinkish color. Young canes densely tomentose, almost woolly, cylindrical, and as they become mature are covered with short spinous hairs, giving to the dark brown striated bark a roughness readily recognized as a specific character. Leaves densely tomentose while young, becoming rugose above and rusty woolly beneath; broadly cordate and lobed, the lobes separated by deeply rounded sinuses; clusters medium to large, compact shouldered; berries medium to large, color variable, from nearly white to black, covered with bloom; tough pulp, and a strong musky or foxy odor and taste. Only one species.

Vitis labrusca, Linnæus, Atlantic States and Tennessee.

GROUP 5. ÆSTIVALES. (*Summer Grape.*)

Vine strong, stocky, climbing; tips of growing shoots sparsely supplied with leaves; young wood tomentose, or nearly smooth in some, while others have a spinous pubescence around the joints; tendrils pale or reddish brown; young buds usually reddish or crimson; leaves medium to large, with loose cobwebby hairs beneath, smoothish when old, and dark green above; berries small to large, with light bloom, mostly astringent, but sometimes sweet and vinous.

Vitis Lincecumii, Buckley. South Texas, var. *glauca*, Munson. North Texas to South Missouri.
Vitis bicolor, Leconte. Kentucky to Michigan, Wisconsin, Illinois, New York, and southward.
Vitis æstivalis, Michaux. Tennessee, Georgia, Virginia, and southward.
Vitis Simpsonii, Munson. Florida.

GROUP 6. CORDIFOLIÆ. (*Frost Grape.*)

Vine slender, climbing; young canes smooth, cylindrical, except in *monticola*, thinly pinkish pubescent in striate lines along the obscure angles, becoming pale reddish brown; leaves heart-shape entire or lobed, blade smooth and shining on both sides, except along the midribs and veins; clusters medium to large, loose, and seldom compound; berries small, black, shining, without bloom except in *V. monticola.*

Vitis cordifolia, Michaux. Iowa to New York, south to Gulf.
Vitis rubra, Michaux. (*V. palmata*, Englm.) Illinois and southward.
Vitis monticola, Buckley. (*V. Texana*, Munson.) Southwest Texas.

GROUP 7. CINERASCENTES. (*Winter Grapes.*)

Vine slender at first, but becoming a strong grower and climbing very high. Young canes densely whitish or rusty, pubescent, or woolly along the angles; buds small, sub-triangular, brown, but in expanding dull pink or rusty crimson; leaves long, cordate, seldom lobed, but variable in the different species, some with upper side rugose, dark, dull green, and only pubescent or whitish woolly beneath, the latter in some of the Southwestern forms; clusters large to very large, loose or compact, compound, with long slender peduncle; berries very small, with thin bloom, or shining black, with a pure vinous taste, intensely acid till very ripe, or when frosted.

Vitis Virginiana, Munson. Mountain Valleys Southwest Virginia.
Vitis Berlandieri, Planchon. (*V. monticola*, Mil.)
Vitis cinerea, Engelmann. Texas, Indian Territory, Missouri, Illinois, Tennessee, var. *Floridana*, Munson, Florida.
Vitis Caribæa, D. C., Eastern Mexico, and West Indies.
Vitis Blancoii, Munson. Sierra Madre Mountains, Western Mexico.

GROUP 8. MUSCADINIÆ. (*Southern Fox Grape.*)

Vine slender, canes short-jointed, angled, tendrils intermittent, buds very small, globose, brown, when unfolding dull brownish-green; leaves small, round, or somewhat cordate, very coarsely toothed with broad bluntish teeth, thin and smooth on both sides; clusters small, loose; peduncle short; berries small in *Munsoniana*, and shining black; without pulp or musky odor or taste, but very large and musky in the *V. rotundifolia*, or common Scuppernong grape of the Southern States.

Vitis rotundifolia, Michaux. All Southern States east of 100° longitude and south of 38° latitude.
Vitis Munsoniana, Simpson. Central and South Florida.

According to the preceding classification, we have twenty-five species of the grape indigenous to North America, instead of less than half that number, as given in the older botanical works; but the later botanists have had much better opportunities of examining the wild vines than the earlier investigators, hence their conclusions are all the more deserving of credence; besides, if not absolutely perfect, they will do no harm, and may aid present and future investigators in determining the true relation of our various species and varieties.

In the following table, from the monograph referred to on a preceding page, the species and varieties are arranged in a convenient form for study, with name of botanist who first described them, where found, etc.:

Genus VITIS, Tournefort (Linnæus in part).

[Explanation: H.—Hardy north; H. H.—Half-hardy north; T.—Tender north.]

SECTION I.—*Euvitis*. Planchon.

	Specific number.
Series 1. *Ripariæ*.	
Vitis rupestris (Scheele), H	1
Vitis riparia (Michaux), H. (*V. palmata*, Vahl)	2
Vitis Solonis (Hort. Berol.), H	3
Vitis Doaniana (Munson), H	4

All excellent for hybridizing other species.

Series 2. *Occidentales.*

Vitis Arizonica (Engelmann), H. H., the "Cañon Grape" of Arizona.. 5

Var. glabra (Munson), H. H...................................

Vitis Girdiana (Munson), T., the Southern California species; mildews 6

Vitis Californica (Bentham), T., the Northern California species; mildews.. 7

Series 3. *Coriaceæ.*

Vitis Champini (Planchon), H. H., excellent, Southwest Texas.... 8

Vitis candicans (Engelmann), H. H., "Mustang Grape" of Texas.. 9

Vitis coriacea (Shuttleworth), T., Florida.......................... 10

Series 4. *Labruscæ.*

Vitis labrusca (Linnæus), H., to which Ives, Concord, etc., belong 11

Series 5. *Æstivales.*

Vitis vinifera (Linnæus), T., European and Asiatic grape..........(a)

Vitis Bourquiniana (Munson), H. H., South European, Herbemont, etc...(b)

Vitis Lincecumii (Buckley), H., "Texas Post-Oak Grape," large, fine... 12

Var. glauca (Munson), H., Northern Texas and Missouri........

Vitis bicolor (Leconte), H., "Blue Grape," "Winter Grape," of Ohio, Michigan.. 13

Vitis æstivalis (Michaux), A., Tennessee, Virginia, Georgia, etc... 14

Vitis Simpsonii (Munson), T., Florida.............................. 15

Series 6. *Cordifoliæ.*

Vitis cordifolia (Michaux), H., "Frost Grape," "'Possum Grape"...16

Vitis rubra (Michaux), (*V. palmata*, Engelmann), H., Southern Illinois, ornamental... 17

Vitis monticola (Buckley), H. H., "Sweet Mountain Grape," Southwestern Texas.. 18

Series 7. *Cinerascentes.*

Vitis Virginiana (Munson), H., mountain streams Southwestern Virginia... 19

Vitis Berlandieri (Planchon), H. H., from chalky soils of Southwestern Texas.. 20

Vitis cinerea (Engelmann), H., "Sweet Winter Grape," Illinois, Texas, and eastward.. 21

Var. Floridana (Munson), Florida and along the Gulf coast...

Vitis Caribœa (De Candolle), T., West Indies and Eastern Mexico.. 22

Vitis Blancoii (Munson), T., Sierra Madre Mountains, Mexico..... 23

SECTION II.—*Puncticulosis*, Munson.

Series 1. *Muscadiniæ*

Vitis rotundifolia (Michaux), H. H., "Muscadine Grape" of the South... 24

Vitis Musoniana (Simpson), H. H., "Bird Grape," ("Mustang Grape," Chapman), Southern Florida.......................... 25

The European and Asiatic species of the grape have passed through almost the same vicissitudes as the American species, in the way of re-arranged classifications by botanists, but at the present day all of the many thousand varieties cultivated in European countries, with the exception of the few introduced from America, are supposed to have originated from one species, namely, the *Vitis vinifera,* and it is not positively known which one of these two thousand or more varieties is the original, although it can be proved that many of them are not; it is, therefore, impossible to give a description of the foreign vine so that it can be recognized by one not previously acquainted with the general appearance of the many varieties belonging to it. Language, however skillfully applied, is often inadequate to describe to others our own knowledge or impressions. For instance, we may have a friend whom we wish to describe to another so that he shall be able to know him among a thousand; but unless the one described has some unusual mark to designate him, twenty may be found in the thousand to answer the description exactly—at least, to a stranger. So it is with the foreign vine; to those who have become acquainted with both it and the native species, it is an easy task to distinguish one from the other, no matter how much each may vary; but to describe the two so that others may learn the difference is not so readily done. Foreign varieties have leaves ranging through all the gradations of color known as green—so have ours; some approach the red—so do ours; many have a very shining surface, and others are downy or woolly—so are ours. The leaf of the European grape also presents every conceivable shape, preserving, however, characteristics enough to be recognizable as belonging to the grape genus. And we have one species, the *Labrusca,* the varieties of which will match any of them in shape. The young wood of many of the foreign varieties is covered with a grayish-blue bloom, said by chemists to be wax; this is sometimes considered a distinctive mark of the foreign varieties, but our *cordifolio* is abundantly furnished with it. We could multiply these parallel characters indefinitely, but enough has been said to show how difficult it is to designate the species to which a particular variety belongs, especially if we have words only for our guidance. There are, however, certain characteristics so prominent that they may serve as a partial guide until some freak of nature admonishes us to lay them aside. 1st. The skin of our native grape slips from the pulp, while that of the foreign varieties adheres to it like the skin of the apple, and those which have a fleshy pulp allow the seeds to drop from it when it is broken. The seeds of our native grapes are enveloped and held together by the pulp, more or less persistent in different varieties; but to observe this the fruit of some of the newer ones must be examined before they are fully ripe, for at that time the pulp has become so tender that it is scarcely more than a liquid. The tough pulp is a prominent characteristic of the *Vitis Labrusca* and its varieties. 2d. The bark of some of the native grapes, particularly on the one-year-old canes, parts very readily from the wood; it is also quite tough, and in some instances it may be divided into small threads resembling hemp, while the bark on the young wood of the foreign vine usually adheres more firmly, and is also quite brittle. The bark of the native vines, particularly the northern species, is harder than that of the foreign one, and the prevailing colors are dark maroon or brown, varying to light orange. Very few of the cultivated native varieties have any bloom upon the young wood, while that of the foreign ones, when grown in the open air, usually has a grayish or ashen hue, and is also more or less supplied with a peculiar blue bloom.

Many other peculiarities might be noticed, but as we do not recommend foreign varieties for out-door culture in the Northern States, there is no necessity of pursuing this subject further.

Propagation by Seed.—As the propagation of the grape from seeds is the only method by which new varieties can be produced, it is all-important to the welfare and prosperity of grape culture in this country that it should receive the attention of all friends of progress in this department of horticulture. Although great advance has been made in the last few years, and we now have a few fine table and wine grapes, yet we have none that are perfect, or but what may be far surpassed, even if only ordinary skill is applied to the growing of seedlings.

The seeds should always be gathered from grapes that are fully ripe, and from the best varieties that can be obtained. Those varieties which have any prominent defect, such as slow growth, thin, small leaves, those that are liable to mildew, vines that are tender, or ripen their fruit very late, should be avoided, unless they possess some excellent quality which it would be desirable to perpetuate, and which can not be found in any other variety. It must not be expected that good, strong, healthy seedlings will be grown every year, even from the very healthiest native variety, as the seeds of the grape are not fully developed every season, although the grape itself may appear to be perfect. I mention this, that those who fail to grow good healthy seedlings on the first trial, may not be discouraged. The next season, with no greater care, they may have perfect success. It must not be expected that all the seedlings, nor any great portion of them, will produce better fruit than the parent, for although the vine has a tendency to improve upon its wild nature—a return, as it were, for the care and labor bestowed upon it—yet after it has taken a few steps toward civilization, a large portion of its offspring shows a disposition to recede to its original state. In growing a thousand seedlings from a choice improved variety, if we succeed in getting one even but little better than the parent, we would be well repaid.

It is this very uncertainty that affords the pleasure and the rarity of satisfactory results which gives value to this department of grape culture. Seedling grapes are from three to ten years in coming into bearing—usually the wildest and the most inferior varieties will grow the strongest, and come into bearing first. I have frequently marked two-year-old seedlings that showed strong indications of their wild character, for the purpose of ascertaining how near one could judge of the worthlessness of a seedling by its leaf and growth. Some of those marked produced fruit when only three years old, and every one of them was as worthless in fruit as they were wild in growth, although all were from improved varieties.

Occasionally a seedling will be grown that will never produce fruit; for (see botanical description) our native varieties are sometimes diœcious, that is, one vine produces flowers having only pistils, and another only stamens. Fig. 2 shows a grape flower (somewhat magnified) after the petals have fallen. The pistil, C, is in the center, while the five stamens, B, surround it. If it should happen to be the former (pistillate), then the flowers may be fertilized from the perfect flowers of another vine; but should it prove to be one of the latter, with staminate, or male flowers, then it will produce no fruit. Although we speak of flowers being staminate, yet we have never seen, nor have we good authority for believing, that there are any varieties or species that are entirely wanting in the rudiments of a pistil, though it may be so deformed that its usefulness is destroyed.

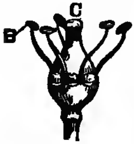

FIG. 2.

FIG. 3.

Again, there will occasionally appear seedlings with both perfect and imperfect flowers on the same vine and in the same cluster; such vines are called polygamous.

These occur more frequently than the diœcious; and if imperfect flowers occur, then, of course, we have very imperfect bunches of fruit, although this may not always be owing to a deformed stigma, but to an insufficient supply of pollen, owing to deformed stamens. The Taylor grape (white) and Oporto (black) are striking illustrations of perfect and imperfect flowers in the same cluster. But the imperfections in the flowers of these seem to be mostly in the stamens, they being very much deformed; for when the cap or petals drop off, the stamens are bent down, as seen, B, in Fig. 3; not standing erect, as shown in Fig. 2.

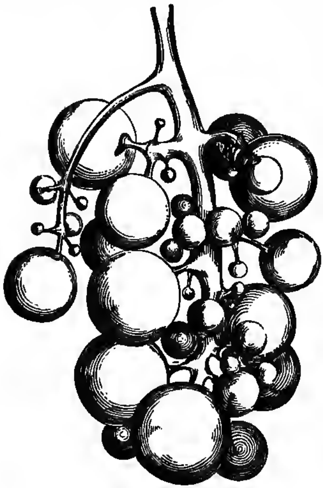
FIG. 4.

Fig. 4 represents a fair sample of the bunches produced upon a vigorous vine of the Taylor. Some of the bunches may contain more perfect berries than the one from which this engraving was made, and others with not more than two or three perfect ones. The small, undeveloped berries are those that were not fertilized. Other varieties of this class show the same phenomenon, and all that I have examined exhibit more or less the deformed stamens, as shown in Fig. 3. The Taylor is a pure native variety, belonging to what appears to be a distinct species, found growing along the Alleghany range, from Southern New York to Alabama, and along the banks of those streams that flow from these mountains. It probably is also found near the Rocky Mountains, as several varieties I have received from Nebraska and Kansas appear to be the same species.

Some of the individuals of this group possess excellent qualities, which, when properly developed, and their defects remedied, will make the most valuable wine grapes of the country.

CHAPTER II.

GROWING FROM SEED.

Gather the grapes when fully ripe, and either dry them in the sun or in a dry room, until they appear like raisins, and keep them in this way until spring, or, when they are gathered, the seeds may be separated from the pulp. Put in pots or boxes, mixed with pure sand or sandy loam, and set away in the cellar, or bury in the open ground, until spring. Mice are very fond of grapes and grape seeds, and they should be placed where these pests can not reach them. No matter whether the seeds are frozen or not, all that is requisite is, that they shall not get too dry; if they are kept cool and moist, their germinating powers will remain unimpaired.

The soil for a seed bed should be light, moderately dry, and thoroughly pulverized to at least two feet in depth. If not naturally very rich, it should be made so by adding a liberal quantity of old, well-decomposed manure from the barnyard, and incorporating it well with the soil. The whole success often depends upon getting a good, strong, healthy growth the first season. So soon in the spring as the weather will permit, sow the seeds in drills about a foot apart, and not too thickly in the drills—one or two inches apart will do; cover about three-quarters of an inch deep, and give a liberal supply of water, if the weather is dry. When the plants first appear above ground, they should be *partially* shaded, to prevent their being burnt off by the sun. The shading may be dispensed with so soon as the second or third leaves are formed, at which time small sticks, say from a quarter to one-half inch in diameter, and two feet long, should be stuck by the side of each plant; every little plant will throw out its tendrils and attach itself to the sticks, and grow much more rapidly than it would if such a support were not given. The stakes, if set thickly together, will afford a partial shade to the young plants, which is often very beneficial, especially if the summer should prove very warm. Another method with which I have succeeded most admirably, is to sow the grape seeds thinly in the drills with apple seeds; the apple seedlings coming up with those of the grape, or usually a little before, afford just sufficient shade for the young vines; and as the vine grows, they fasten themselves to the young trees, which serve in place of stakes. A still better plan would be to sow the apple seeds in drills, running east and west, one foot apart, and the seeds about one inch apart in the drill, after which sow the grape seeds on the north side of the drill, but close up to them, say within two inches, at least. I use apple or pear seeds, instead of cherry, peach, or similar kinds, because they produce but very few side roots the first year, and, consequently, do not interfere with the growth of the seedling vines. When the plants have made a few inches of growth, a light mulch of leaves, hay, or moss may be spread over the entire surface of the bed; this will keep the roots moist and prevent any sudden check to their growth. If the weather should prove dry, give an occasional watering—not a sprinkling, but a good soaking; once a week will be sufficient. No liquid manure will be needed if the soil was properly enriched when the bed was made; but if the vines do not grow as rapidly as desired, then put a few shovelfuls of good fresh barnyard manure into a barrel of water, stir it well, let it settle, and then draw off the water and apply it to the plants; or, instead, a solution of two pounds of guano to a barrel of water may be used with good effect. If there should be signs of mildew on the plants, a few handfuls of sulphur, scattered over the plants and bed, will usually prevent its further progress; or spraying with some of the fungicides recommended under "fungous diseases" will answer equally as well, or, perhaps, better. Grape seedlings, when well started, usually grow quite rapidly, often making two to four feet of wood the first season.

Those who have greenhouses or hotbeds may sow the seeds in boxes or seed-pans, and place them in these structures, so that they may receive artificial heat; but for growing hardy varieties the open ground is preferable, as it is more natural; and the sickly seedlings, of which there are always more or less, will be more likely to show their feebleness in the open ground, and can be selected from the vigorous and thrown away, avoiding further trouble. When the plants have made one season's growth, and the frost has killed their leaves, they should be taken up, a portion of the stem cut off, and the long perpendicular root shortened at least one-half its length; then heel them in in some dry, warm place in the open ground. All small, sickly looking plants should be thrown away, for they will seldom make good vines if they fail to make a good growth the first season. At the approach of very cold weather cover the entire tops with soil or coarse litter, deep enough to insure them against being severely frozen; not that freezing would be sure to kill them, but it would tend to impair their vitality. In the spring take out the plants and cut the stems off to within four inches of their roots, then plant them out in rows four feet apart, and three or four feet apart in the rows. The ground for their reception should be made rich and deep, using any old, well-decomposed manure that may be at hand, or old sods or muck; if the latter is used, a peck of ashes to the square rod, or half that quantity of lime, may be added, with good effect. The whole soil should be worked over at least eighteen inches deep, either with the plow or spade.

The roots of the vines should be carefully spread out, so that no two will come in contact; then sprinkle the soil among them, covering so that the upper bud on the four-inch stem will be just above the ground; this will give about three inches of soil above the upper tier of roots, which is sufficient for young plants, and more than this would be injurious. After the vine is planted press the soil down with the foot, so that it shall be firm, but not packed. A good strong stake, say one and a half inches in diameter, and six to eight feet long, should now be put down by each plant to tie it to as it grows. Let but one shoot grow, and pinch off all side branches as they appear; keep the vine tied to the stake so that it shall not get broken off by the wind, and thereby checked in growth. Keep the ground clear of weeds, and stir the surface often with the hoe or rake, but never deep enough to reach the roots. On very loose and porous soils it is better to mulch the plants; but if the soil is a compact loam, or somewhat clayey, then it is better to hoe often than to mulch, because if you cover up soils that are naturally compact, they will hold too much moisture, and sometimes become soured for want of aeration.

At the end of the season's growth, and just before the ground freezes, the vines should be pruned, by cutting them back to within eight or ten inches of the ground; then bank up the soil about them, or bend them down, and then cover them; if covered with straw or leaves, there is danger of their being destroyed by mice. All that is now required is to protect them slightly from the sudden changes in winter. The following spring remove the covering and give the vines a top-dressing of manure, and work it in with the hoe during the summer. The vine should be allowed to make only a single shoot this (the third) season, and if healthy and vigorous, it will make a growth of ten to fifteen feet if not checked; but if allowed to grow unchecked, it would necessitate very long and stout stakes, besides the trouble of keeping them tied. It is best not to allow them to grow so long, but pinch off the tops when they have grown five or six feet high, and when they start again and have grown a foot or more, check them again; also pinch off the ends of all the side shoots, or laterals, as they are termed; this concentrates the strength of the vine, and hastens its maturity.

The vines are now three years old, and we may begin to look for fruit next season, if they have not already shown it upon some of the strongest. But to be sure of getting a strong growth next season, we should prune the vines back to two feet, and allow but two shoots to grow; and further, they are more likely to produce fruit from the lower than the upper buds, particularly if cut back.

This cutting back may be deferred until the last of February, unless it is desirable to cover the vines again, which it is not, unless the climate is so severe that it is not expected they will ever withstand the winter. In the vicinity of New York I would not cover seedlings after the second season.

We have now followed our grape seedlings until they are four years old; they should now be kept pruned pretty short, say to two or three buds of the previous season's growth, every season until they have fruited, and then select those that promise well and discard the others. If cuttings or layers are taken from the seedlings, they will often produce fruit before the parent plant. For the manner of making these, see chapter on propagating by layers and cuttings.

CHAPTER III.

PROPAGATION BY SINGLE BUDS.

The mode of propagation of the grape from single buds, or eyes, is particularly valuable, when it is desired to increase rare and desirable varieties. It is supposed to have been first suggested by the Rev. Mr. Mitchell, of England, in 1777, and has been practiced sufficiently to establish its true merits—some of which are: 1st. A greater number of plants can be produced from a given quantity of wood than by any other mode. 2d. Vines so propagated contain just enough of the parent vine to insure the perpetuation of a healthy plant of its kind, but not enough to transmit disease to it by its decay, as sometimes occurs when a large amount of the old wood is used. 3d. As in this mode of propagation so small an amount of wood is used that it admits of a large number of cuttings being started in a small space, and as the buds are nearly always forced into growth by artificial heat, we may commence much earlier in the season than when propagating in the open air, thereby giving a much longer time for increasing, prolonging, and ripening their growth. This is secured, even if they are planted out in the open ground, so soon as the plants become well rooted and the weather sufficiently warm. 4th. But the greatest benefit arising from this mode of propagating is, that varieties that are very difficult to increase by other methods, can be multiplied with the greatest facility by this. In fact, no variety or species has yet been discovered that can not be grown readily with artificial heat from single bud cuttings.

Vines properly grown from single buds are certainly equal to those propagated by any other mode; but if improperly grown, they are of but little value, and often entirely worthless.

The buds used for propagating should be large and well developed, and at no time of their growth should the plants be allowed to receive a check, either by being too cold or too hot. While it may be necessary to keep up a vigorous growth, it must be borne in mind that the plants may be forced too rapidly by the use of stimulating manures, and by subjecting them to too great heat, the result of which will be soft, spongy, unripened wood and roots. Sometimes the roots will have small tuberous appendages at their ends, which is often caused by the presence of too much stimulating food. When vines are propagated from single buds, and are kept in pots during the entire season, the enlargement of the ends of the roots will usually occur upon all those that grow out until they reach the sides of the pots. This does not show disease nor overgrowth, but merely that the roots are crowded, and that they need more room. But when these little tubers are found on the small roots all through the soil, it shows that they have been made unhealthy by injudicious treatment, or have been attacked by the grape louse (*Phylloxera*), which will be described in another chapter.

Mode of Operation.—Cut the wood from the vines in the fall, after the leaves have fallen, but before it has been severely frozen, and put away in moist earth or sand in the cellar, or bury it in the open ground, where it will be protected from the frost and can be reached when wanted. The last of February or the first of March is the usual time, in this latitude, to commence starting the buds. There is nothing gained by forcing the buds into growth too early; better wait until the season arrives when they naturally begin to swell, as they will then grow more readily and make more healthy plants than if started in the early part of winter. At this time take out the cuttings and cut them up into pieces, as represented in Fig. 5; put these into water as they are cut; this will prevent their becoming dry while they are being prepared; and if they are allowed to remain in the water for twenty-four to forty-eight hours, it will do them no harm, but often be of benefit, especially to the hard-wooded varieties, as it softens the alburnous matter from which the roots grow, and loosens the outer bark, and thereby allows the roots to push through it more readily, there being always more roots produced from other parts of the cutting than from that part where the cambium has been exposed by the knife. It is also a benefit to some varieties that produce roots very tardily, to scrape off a portion of the outer bark and the remains of the old leaf-stalk which immediately surround the base of the bud, so as to partially expose the inner bark.

FIG. 5.

When a quantity of the buds are prepared they should be put into moderate-sized pots (six or eight inch is a convenient size) filled to within about an inch of the top with pure and moderately coarse sand, firmly packed. Place the cuttings, with the buds up, about an inch apart all over the surface, press them down firmly with the thumb and finger; sift on sufficient sand to cover the upper point of the bud about a quarter of an inch deep, then press it all down evenly, using the bottom of another pot for the purpose, after which apply water enough to just moisten the whole contents of the pot.

Sand taken from the banks of fresh-water ponds or running streams is the best for propagating purposes, as it is nearly free from impurities. That taken from common sand banks often contains oxide of iron and other foreign matters to an extent that renders useless all attempts to grow anything in it. When pure sand cannot be obtained, the other can be made to answer by exposing it to the action of the air and rains for a few months, or by washing it thoroughly before using.

After the pots have been filled with cuttings, they should be placed in a temperature between 40° and 50°, and allowed to remain from two to three weeks, watering just enough to keep them moist, but not wet. As roots are formed at a much lower degree of temperature, and less rapidly than leaves, we are thus enabled to cause the process of rooting to begin (which is very essential) before we place them in a position to commence growth; and when this does start, the roots, being formed, or in process of formation, will then issue with such rapidity that they will be capable of absorbing food to supply the new growth as soon as it has consumed that which was laid up in the bud the previous season.

After removing the pots from their first position, place them in the frames, which should be partially filled with sand and located over the flues or hot-water pipes, plunging them at least one-half their depth in the sand; give them bottom heat of 60° for the first few days, then gradually raise it to 80°; keep the frames partly open, and the temperature of the atmosphere in them ten degrees lower, if possible, than that of the sand under them, bearing in mind that we wish to excite the roots to grow before the leaves. When the buds begin to push, allow the temperature to increase to 90° or 95°, close the frames and keep the atmosphere moist by frequent waterings; a liberal application once a day will usually be sufficient. Pure rainwater is best, and should always be of the temperature of the air in the house, or nearly so. Cold water would surely check the growth of the plants. Examine the young growth every day to see that it does not commence rotting, or damping off, as it is called; should there be signs of this, give a little more air; but be careful of cold currents from the outside, as these are often fatal to the young plants. Also avoid the direct rays of the sun, either by whitewashing the glass, or nailing up strips of white muslin or paper to the rafters of the house.

When the plants have made a growth of two or three inches, they should be shifted into two-and-one-half to three-inch pots, putting one plant into each.

Up to this time no material has been used which contained any appreciable amount of plant food, nor has it been needed, for the growth of roots and leaves has been produced from the food stored in the bud and the wood attached, and what little they may have obtained from the air, water and sand. The plants are now in condition to use more substantial nutriment, consequently the soil in which they are to be potted may be composed of rotted sods, taken from an old pasture, mixed with one-half its bulk of old, well-decomposed barnyard manure, or instead of sods use muck, or leaf mold from the woods. These should be mixed together at least six months before using; add one-eighth to one-quarter sand, and turn all over until it is thoroughly incorporated, then sift it all through a coarse sieve before using. Having put a quantity of the soil upon the potting bench, which should be in the propagating house, and provided a quantity of broken pots or bricks for drainage, take the pots containing the plants from the frames, lay them on their side and give them a sudden jar with the hand, so as to loosen the sand around them; then draw out a plant carefully and hold it in one hand, while with the other you place a small piece of the drainage material in the small pot, cover it with soil, then put in the plant, allowing the roots to spread out naturally; fill in soil around them until the pots are full, without covering the roots where they join the stem more than half an inch deep; press the soil down firmly, but not so hard as to break the roots. When the plants are potted, place them again in the frames, give them water to settle the soil about their roots, and keep the air somewhat confined for a few days, until they have become well established in the pots, when a little more air may be given them. Keep the temperature at 85° to 95° during the day, and 60° to 70° at night. When the plants have made four to six inches of stem they may be taken out of the frames and placed in another house, which, if they are to remain under glass during the season, should have been made ready for their reception.

Some propagators do not use frames within the house at all, but depend entirely upon keeping the air moist and hot, as well as sufficiently confined, by the ordinary methods of heating and ventilating the house. While an experienced propagator will usually succeed in this way, for those who have not had experience in propagating the frames are much safer, and are enough better to pay the extra cost, even for the use of the most skillful.

When the plants are first potted in the small pots they will require so much more room than before, that it will often be found inconvenient to furnish frames enough to hold them; in such cases they may be set upon shelves in the open house, and they will do well in such a position if care is given in keeping the atmosphere within the house moist and warm, as well as in shading the plants and avoiding direct currents of cold air from the outside through doors or when ventilating the house.

To get good, large, and strong plants, they will require repotting at least three times during the summer. At each change the pots used should be increased in size about two inches. The same compost may be used for each repotting, and the ball of earth around the roots should not be broken, neither should the plants be placed more than a half inch deeper than before. The proper time for repotting is when the roots have reached the sides of the pot and become crowded. The fresh soil put around the roots should be pressed in firmly, to make it of the same density as the ball of earth containing them. The plants should always be kept tied to stakes, and the ends of side shoots pinched off, not allowing more than two additional leaves to remain on them at any one time. The plants should also be allowed plenty of room, so that their leaves may fully expand, and receive plenty of light and air. If this is not attended to they will grow tall and slender, and often fail to ripen their wood; besides, they will be very likely to be attacked by mildew. The plants should receive the direct rays of the sun from the time they are firmly established in the small pots.

To hasten the ripening of the plants, toward autumn pinch off the top, and lower the temperature by giving them more air. A little close observation during the growth of the plants will enable the propagator to judge of their wants, and the proper amount of water, heat, etc., they require. Sometimes it will be necessary to give them a little liquid manure, but this will seldom be required if the compost in which they are grown is properly made and the plants allowed good-sized pots.

The propagation of our hardy varieties from single bud cuttings in houses is not now practiced as extensively as it was years ago, but it is still employed for multiplying new and scarce sorts, as well as for foreign varieties raised for growing in graperies.

Planting in Beds.—To avoid the expense of a sufficient number of pots of the various sizes required for repotting a large number of plants several times during the season, cheap glass structures, without artificial heat, may be erected, and the soil in them made rich, into which the plants may be put directly after they have become well rooted in the small pots in which they are placed at the first potting. These beds may be made with the natural soil in the house, or they may be made of strong plank frames, deep enough to hold a foot of soil, and elevated some two feet from the ground; in this manner the roots receive more heat than when planted in the natural soil. The same care will be required, the same watering, staking, etc., as if they were in pots. Plants of superior quality may be grown in this manner, with much less expense and trouble than attends those that are grown in pots through the season.

Single Buds in Open Air.—This is another and cheaper mode than the two preceding methods, as the expense is but trifling after the plants leave the propagating house. But when vines are to be grown in this manner, they should not be started too early, for the weather must have become warm and settled before they can be planted out.

The method is as follows: When the vines have been repotted into the small pots and are well rooted, they are turned out and planted in beds previously prepared, in the following manner: First make the soil rich and deep, and have it thoroughly pulverized and raked level and smooth; then lay it off into beds three feet wide, and the required length; drive down strong stakes along the sides, to which nail boards to the height of two feet or more, then across the top nail a few strips to keep all firm. Stretch oiled or plain muslin over the top, for shading the plant when first set out. When all is ready, take the plants from the house and turn them out of the pots (being careful not to break the ball of earth as it is slipped from the pots), and plant them about a foot apart each way in the beds, Now water them, and place the muslin over them when the sun shines, for at least one week; by this time they will have begun to extend their roots into the fresh soil, and the covering may now be removed; but the boards at the sides should remain all summer, as a protection against wind and severe driving rains. Water the plants as often as needed; cover the soil with two or three inches of mulch; clean straw, hay or leaves are good, and perhaps the best for this purpose. Keep the plants tied to stakes, etc., as already directed. It is no unusual thing for plants, grown in this manner, to reach the height of six feet the first season, and they are usually more stocky than when grown all the season under glass.

It is best not to start all the plants in the propagating house at one time, as in that case they will all be ready to be repotted or planted out at the same time; but they should be started at different periods, say a week or ten days apart, making two or three lots, especially if there is a large quantity to be grown. Then the different stages of growth will enable the propagator to attend to each lot as its growth requires, and at the proper time. When the plants are set out in the open ground, as I have described, the material used for shading the first lot may also be used for the second, and so on, instead of being compelled to purchase enough to cover all at one time. The boards for protection are sometimes omitted, as well as the shading, and in some protected situations they may not be needed. There is also a great difference in the texture of the leaves in the different varieties, some being capable of withstanding sun and strong currents of wind much better than others; yet I believe all will grow enough better to pay for the expense of protection.

Starting in Hotbeds.—The main object in making a hotbed is to produce artificial heat, and to have this heat continue uniformly for several weeks. For this purpose various materials are used, such as tan bark, leaves, hops that have been used by the brewers, etc.; in fact, almost any fibrous material may be used, that will continue to ferment a sufficient time to produce the amount of heat necessary to cause seeds and cuttings to grow, and keep the soil and atmosphere within the bed from twenty to forty degrees above the freezing point, even if the atmosphere without is far below. Besides the materials for producing this heat, we must have a structure called hotbed frames, in which we may control it when generated. These are made of planks of any required size, with a sloping top covered with sash. They may be of any length or breadth, but they are usually four to six feet wide, and of any convenient length.

The sashes are made without cross-bars, and of a length sufficient to cover the frames crosswise. If the frames are six feet wide, then the sashes may be six feet long and four feet wide; but if the frames are but four feet wide, the sash may be three by four; these are convenient sizes. The size of the glass is immaterial, but six-by-eight and eight-by-ten are sizes commonly used. As there are no cross-bars to the sash, each pane of glass is made to overlap the one below it from one-fourth to one-half an inch, like the shingles on a house. The more the glass overlaps, the more liable it is to be broken by the freezing of the water, which will always accumulate, more or less, between the panes. The glass should be bedded in soft putty, and fastened with glaziers' points, the sash well painted; but put no putty upon the upper side of the glass. If anything is needed to stop the joints between the edges of the glass and sash, apply thick paint. If the glass is well bedded in putty, nothing more than painting the upper side will be required, and they are far better without the putty than with it.

The hotbed may be, as we have said, composed of various materials, but in any case they should be prepared some time before they are wanted for use. When leaves are used they should be obtained in the fall, and placed where they can be turned over several times during the winter, and a proper degree of moisture retained; and other materials should be treated in the same way. Hops may often be obtained from the breweries in a state of fermentation, and then all that is required is to immediately put them into a proper shape, and place the frames over them. But such materials are comparatively little used, horse manure being equal, if not superior, to any other for the purpose, especially when a small quantity of leaves is mixed with it. It is not necessary to describe the mode of preparing hotbeds with other materials, as the process is similar with each. The manure should be taken as fresh from the stable as possible, thrown into heaps to ferment, and worked over several times; all large, coarse lumps broken into pieces, and if it becomes dry, add water to keep it from becoming burnt and musty. This working over is to cause the fermentation to act upon all parts, and to give it an even texture throughout. If leaves can be had, they should be mixed with the manure when it is being worked over. One-fourth to one-half the quantity may be of leaves.

If the ground is quite dry upon which the hotbed is to be made (and such a situation is always preferable to one that is wet), make an excavation one foot deep and one foot larger than your hotbed frame; then spread in the manure and leaves in a layer about six inches thick, and beat it down evenly with the fork, then put on another layer and strike it down in the same way, and so on until you have at least two feet in depth; three feet would be still better. By spreading the manure in layers, and pressing each down separately, a more uniform degree of texture will be obtained, and, consequently, a more even temperature will be had throughout the bed. Bank up on the outside even with the top of the frame with the fermenting manure, so as to assist in keeping out cold air, as well as to prevent the escape of the heat which is generated within.

Fig. 6 shows a hotbed of four sashes when completed.

When all is neatly finished, put on the frames, close the sash, and keep all tight. If it is cold weather, cover the sash at night, and in cloudy weather also, with straw

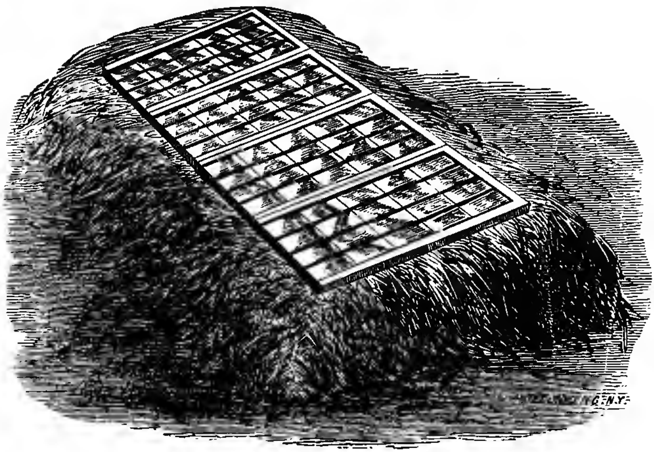

FIG. 6.

mats or board shutters, so as to allow as little heat to escape as possible. So soon as the bed has become warm and the steam begins to rise, which will usually be in four to six days, cover the whole surface of the manure within the frames with fine soil to the depth of four inches, and so soon as this is warmed through, the bed is ready for use.

The pots containing the buds—which should have been prepared several days, or even weeks, previous, and have been kept in the cellar or some convenient place away from the frost—may now be plunged into the soil, nearly or quite down to the manure. The buds, or cuttings as they are called, should be made in the same manner and potted in the sand, as recommended for the propagating house.

Our main object now is the same as before; that is, by the assistance of bottom heat to excite the roots into growth before the leaves; therefore, before the leaves start, admit as much air as possible without cooling the soil or causing a too great waste of heat. "Head cool, but feet warm," is applicable here, for the first week or two; but so soon as the buds push above ground, then the air should be kept more confined, to prevent a too great evaporation from the leaves as they expand. The same care in regard to watering should be given as when grown in the propagating house; also shade the young plants in a similar manner. We do not want to exclude light so much as we do to avoid the direct rays of the sun, while the leaves are small and the plants are forming roots. Give the plants air by lifting one end of the sash a few inches whenever the weather is fine, and the thermometer goes above 90° or 95°. The atmosphere should be constantly humid, but do not so saturate the soil as to cause the plants to rot or mildew; also avoid sudden changes from extreme heat to cold, for a change of 30° to 40° will most surely give a check to the growth, and this is almost certain to be followed by disease. So soon as the plants have rooted pot them off into two or three inch pots, and place them again in the frames.

If the weather has become quite warm, they may be placed in frames where there is no bottom heat. The propagator must be his own judge in this matter, only bear in mind that a heat of 70° to 80° must be maintained to insure success; and if this can be had without bottom heat, then the latter will not be necessary.

The plants may be kept in these pots until they are well filled with roots, then they may be planted in the open ground as before directed. Some of the hardy grapes, such as Concord, Hartford Prolific, etc., have such a thick and enduring leaf that it is not positively necessary to erect frames to protect them when first planted out, yet even these will be benefited by so doing.

When the soil in which the young vines are planted is thoroughly prepared they will require but little care during the summer, except to keep down weeds, and even this will not be needed if they receive a liberal mulch. But it will sometimes be necessary to water the vines in locations where drouths occur, and there are but few sections entirely exempt; therefore it is expedient to be always ready for such an event, by saving an abundant supply of rain water, if possible, and where this can not be done, let there be casks or cisterns made, in which well or spring water may be placed to become warm by the time it may be wanted.

Form of Single-bud Cutting.—Thus far I have mentioned but one form of making one-eye cuttings, yet the shape may be varied to suit the fancy of the propagator, so long as a sufficient amount—but not too much—wood is left adhering to the bud. Fig. 7 shows one style; in this the wood is cut off about three-quarters of an inch above and below the bud, and the wood on the side opposite the bud is cut away deep enough to expose the pith the whole length of the cutting; the cutting is then placed in the sand, with the bud upon the upper side, pressing it down horizontally, as it is shown in the cut. The advantage claimed for cutting away the wood is, that it exposes to the soil a greater surface of alburnous matter (or, strictly speaking, the cambium), from which the roots are produced.

FIG. 7.

If the roots from vine cuttings were dependent upon the exposed cambium, as with some other plants, then the superiority claimed might be conceded; but such is not the case, as a greater part are produced from around the base of the bud, or pushed through the bark from other points on the surface of the cutting.

In Fig. 8 the cutting is made square across, close at the base, or just under the bud, leaving about an inch and a half of wood above it. It is placed in the pots at the angle shown, the dotted lines indicating the surface of the sand above the bud. The advantage of this form, if any, is that it exposes the cambium to the soil at a point where it is to be found in the greatest abundance, *i. e.*, at or near the base of a bud.

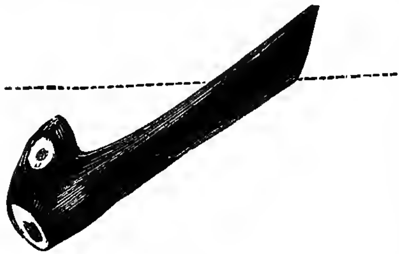

FIG. 8.

Fig. 9 is another form of making the cutting so as to expose as large an amount of cambium to the soil as possible; and further, to have a portion of the cutting go deeper into the soil than in the other forms, thereby avoiding suffering for want of moisture, if, by accident or neglect, the soil in the pot should become dry near the surface, which would destroy the cutting if made in the other forms.

The cutting is placed in the pots in a sloping position; the dotted line above the bud represents the surface of the sand. The only objection to this shape is, that being made thin at the lower end, it is more likely to become water-soaked and decay than if left with more substance. It is, however, a good form, and has some advantages over several of the others. There is not only a great diversity of opinion in regard to the shape of the cutting, but also the best material in which to grow them. Some successful propagators use leaf-mold from the woods, others loam, charcoal and loam, burnt clay, etc., etc., but none of the materials have the least advantage over pure sand, in which to start the cuttings, and a majority of propagators, if I do not mistake, use pure sand in which to place the cuttings until they form roots. It is not only the safest material for the inexperienced propagator, but it is all that is required by cuttings, in the way of soil, until they are in a condition to absorb food through their roots. Sometimes it is well to place a little rich soil in the pots—an inch or so below the cuttings—so that when the roots reach that depth they will find nutriment to sustain growth; in this case the repotting may be deferred longer than would be safe without such a precaution. This is often done by those who expect to have more work on hand than they can attend to at the proper time. Circumstances will sometimes occur when it is not convenient to start the cuttings in pots; if so, they may be put into shallow boxes or directly into the frames, but when this is done, the plank used in making the boxes or frames should be new; if not, they should be coated on the inside with ordinary water cement, mixed thin, and laid on with a brush, or covered with slate. Planks that have been used one season will usually have begun to decay, and this rotting is often the source of a fungus that will spread rapidly through the damp, warm sand, and this is very likely to kill

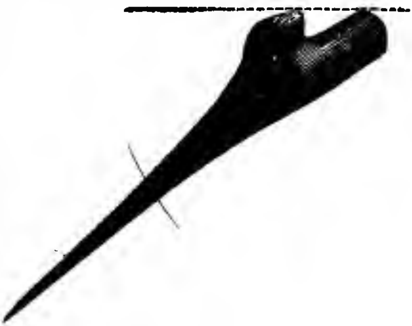

FIG. 9.

every young root with which it comes in contact. I have known many a thousand cuttings to be destroyed by fungi, while the propagator was searching for a cause in another direction.

Single bud cuttings are sometimes grown in open air without starting by artificial heat. They should be made early in March and put away in damp sand or moss, so that the callus will form by the time the weather is sufficiently warm to plant out. Then plant in beds, and cover about an inch deep with soil, and about another inch of mold over all. Sawdust, tan, or common moss are excellent materials for this purpose. In dry weather water the same as if they were under glass.

CHAPTER IV.

CUTTINGS OF UNRIPE WOOD.

Although the grape vine may be readily propagated by cuttings taken from the vine while in active growth, circumstances seldom occur when it is judicious to do so. Unless more than ordinary care is bestowed upon the young vines throughout the entire season, they will not only be feeble, but often so diseased that they never become strong and healthy, though at first they may give promise of being so.

During the prevalence of the "grape fever," some thirty years ago, many thousands of vines were annually raised from unripe wood, or green cuttings as they are usually termed, but it is questionable if the purchasers of such vines would not have been better off, on the whole, without, than with them.

That good, strong and healthy vines are sometimes produced from green cuttings, I admit, but also assert that the great majority are worthless. The facility with which vines may be multiplied in this way is a great inducement, to those who are disseminating the new and rare varieties, to use it. It requires no more skill than propagating from single buds; all that is requisite is to have a propagating house (or even a hotbed will do), where a steady and uniform high degree of heat can be maintained.

The mode of operation is as follows: Place the vines from which you desire to propagate in pots, or plant them in the ground within the propagating house, and make the soil in which they are planted very rich, so that they shall not want for food. When the vines have made a new growth of a foot or so, take off the young shoots, or a portion of each; do not cut back all the shoots at one time, as this might too severely check the growth of the vine, but three-quarters of the number may be cut back, or entirely removed, without doing any injury.

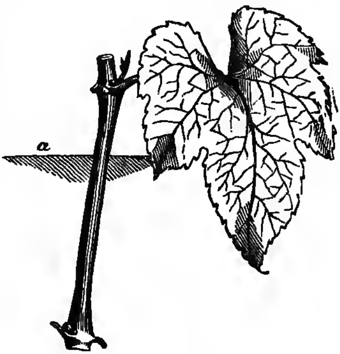

FIG. 10.

The young shoots that have been selected for cuttings should be divided into pieces of two buds each, cutting them off just below a bud; the leaf adjoining the lower bud should be removed, but the upper one must be left entire. Fig. 10 shows the appearance of the cutting when ready for planting; *a* shows the surface of the soil when placed in the pots. Plant these cuttings in six or eight inch pots filled with sand, putting several cuttings in each, but not crowding them; press the sand down firmly around the cutting, leaving only the upper leaf and bud uncovered, and then put the pots within the frames in the same manner as described for single eyes. To prevent rapid exhalation from the leaves, the atmosphere in the frames should be kept a little more confined than for ripe wood cuttings. Ventilate the frames but little until roots are produced. Keep the heat from 80° to 90°, and see that there is plenty of moisture, but not so much as to rot the cuttings or cause them to mildew. Ventilation will usually check the mildew, and withholding water prevents rotting.

In from two to four weeks, if successful, the cuttings will be sufficiently rooted to be separated and put into small pots. An occasional examination of the cuttings will enable the propagator to determine the proper time to do this. When the roots are two inches in length they should be removed from the large pots and placed in three inch pots, filled with the same rich compost recommended for other cuttings, except that the soil is mixed with sand enough to constitute one-half its bulk.

After being potted they should be again placed, for a few days, in the close frames, until they have recovered from the check received in potting. The plants may now be treated the same as the single-eye cuttings, except, if you wish to produce good plants, it will be necessary to keep them under glass the whole season, as the wood will usually fail to ripen fully in the open air.

When but few plants are to be grown, or there is no lack of room, they may be started in the following manner: Take an eight-inch pot and put some broken pieces of pots or coarse gravel in the bottom for drainage, then set a four or five-inch pot within it—the hole in the bottom of the smaller pot being stopped tight; fill the open space between the pots with sand, in which insert one row of cuttings an inch and a half or two inches apart, letting the base of each cutting touch the inner pot, which is to be filled with water; enough of this will percolate through the pot (if it is of the ordinary kind) to keep the sand sufficiently moist. This is a safe mode, and will often be successful when all others fail. The pots are to be kept within the frames until the cuttings are rooted, the same as before. Fig. 11 shows the arrangement of the pots; *f*, *f*, *f* are the cuttings; *c*, *c*, sand between the pots; *d*, water in inside pot; *a*, clay with which the hole in the bottom of the pot is closed; *b*, drainage in the outside pot.

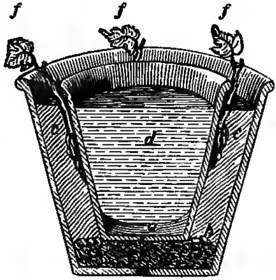

FIG. 11.

The wood of which the cuttings are made must not be too young or too old, but must be taken just at the proper time; that is, when it begins to show a slight firmness, but is not really hard nor fully formed. If the growth of wood is very rapid, it is well to check it by pinching off the end of the shoot a day or two before it is wanted for use. After one set of cuttings has been taken off, another set will soon push out; these are to be removed when three or four inches long, cutting them close up to the main stem, so as to preserve a portion of the enlarged part at the junction; also cut off an inch or so of the small end of the shoots; these will usually grow more readily than those taken at first.

The young growing wood from vines in the open air may be used, but it does not strike root so readily, or make as good plants as that from vines grown under glass. All the varieties of the grape may be grown from green cuttings, but some root more readily than others, and there will also be a great difference in growth of the plants, some starting vigorously and continuing so through the season, while others, under the same treatment, will be but poor, feeble plants at the best.

The propagator should always decide as to the value of a particular mode of operation by the results. The object is to make good vines, and it matters little how it is done, provided the point is gained. Some growers will produce good healthy vines from both green and ripe wood, while others fail with either. Therefore, the best method is that which produces the best vines; but this point cannot always be decided by the size or appearance of the vines, for the reason that a general inherent feebleness is often hidden while the plants are undergoing an unnatural forcing process. My own experience has led me to think that the surest way to produce vines of the best enduring qualities, is to use none but the most fully developed wood; remembering, however, that developed does not mean an overgrown, forced production, either under glass or in the open air.

CHAPTER V.

PROPAGATING HOUSE.

Propagating hardy vines under glass for general vineyard purposes is now seldom practiced; at least, not to the extent that it was a few years ago, and the greater part of those used are raised in the open ground, as described in a succeeding chapter. But in instances where it may be necessary to rapidly multiply new or very rare varieties, a well-arranged propagating house will be found very convenient and useful, and for this reason I repeat in part what I said on this subject in the earlier edition of this work. It is not expected, however, that every one will have the means at command, nor would it always be expedient, if they had, to go to the expense of building an extensive propagating house, unless it were desirable to produce a large number of vines, and for several years in succession. The size of the house will depend entirely upon the number of plants to be grown. If only a few thousand are to be produced, then only a small structure will be required; for the best vines, or the best plants of any kind, are not always produced in the most expensive houses. Many a careful propagator annually produces his few thousands of superior plants with only a small lean-to house, heated with a common brick furnace and flue, and these, perhaps, of his own make. And while this same propagator might tell you that he would prefer, as a matter of convenience, a propagating house with all the modern improvements, still he would scarcely admit that the plants produced in his small, cheap way, were any more liable to disease, or in any way inferior to those grown in the most elegant and expensive house.

Fig. 12 gives an interior perspective view of a section of a first-class propagating house. It may be made of almost any length or width that is desired, but eighteen to twenty-five feet is the usual width for a span roof.

The sides of the house may be of brick or stone, or of two thicknesses of plank, one nailed on each side of good strong posts set firmly in the ground, and the space between filled with tan-bark or sawdust. The common cement and gravel wall, such as is used in some parts of the country, will answer the purpose as well as any other, and in many places would be most economical. The wall should be low, seldom above two and a half feet, on the top of which put a two-foot sash, which will make the eaves of the house four and one-half feet from the ground. Bank up the wall on the outside, and cover the embankment with sods. The glass should be of the best quality of plate or sheet. This is preferable to cheaper kinds. Embed with putty and fasten with gla-

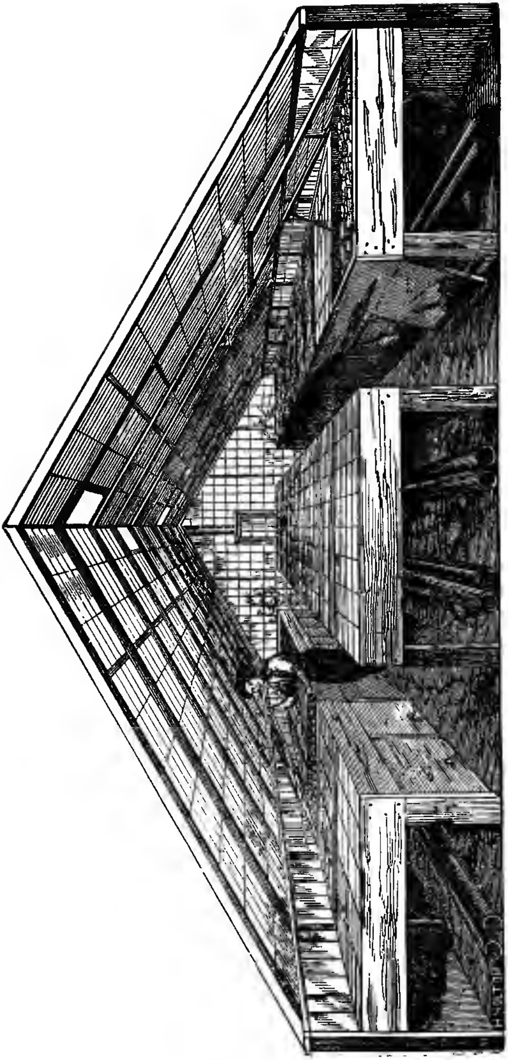

FIG. 12. SPAN-ROOFED PROPAGATING HOUSE.

zier's points, but put no putty on the outside—use nothing but thick, pure white lead paint. The size of glass is immaterial, but if the best and heaviest is used, then the panes may be of any size, from 8×10 up to 10×16. The engraving shows the interior arrangement very minutely, except the posts which will be necessary for supporting the roof. The house stands its longest way north and south; the southern end is of glass, which may reach to the ground, or stop at the height of the frames. At the north end is the furnace room, where also the potting bench, pots, etc., may be kept. The best and most economical mode of heating a large house is by means of steam or hot water. For this purpose there are several kinds of boilers in market, many of which are very good.

The hot-water pipes should lie side by side, instead of one over the other as they are usually placed in ordinary greenhouses. The flow-pipe passes under one of the side frames, thence through and back under the middle one, and then under the frame on the opposite side. The return pipe passes back along by its side, both lying on iron rests made for the purpose. This arrangement gives eight pipes the whole length of the house, besides the elbows and the few feet that it takes to cross the end. The center frame has four pipes under it, while the side frames have but two.

The center frame may be used for starting those varieties that are the most difficult to strike, or the pipes may only pass under the two outside frames, and the center one be used for the plants when they are first placed in the small pots—or the pipes may pass under the center frame and return under the outside ones, without returning, as shown.

If the house is twenty or more feet in width, then for convenience the center frame should be double the width of the outside ones, and in that case the four pipes will be needed under it to keep its temperature equal to the others. Again, in place of frames through the center, a table may take its place, on which to set the plants after they become sufficiently rooted not to need so much heat or so confined an atmosphere as while young.

The inside frames are only necessary while the cuttings are rooting, and for a few days after the first shift, but they are indispensable when a number of varieties are to be grown, for the air cannot be kept sufficiently confined in a large house to insure success with all. To be sure, there are varieties that will grow from single-bud cuttings without recourse to frames, but with such as the Delaware, which seldom shows any roots until the young shoots appear, it becomes a very difficult matter to prevent a too rapid evaporation from the young leaves in the open house. If this takes place of course the cutting dies, for, until the roots are produced, the young growth is supported entirely upon the alburnous matter contained in the cutting.

The frames are ventilated by raising one end of the sash, as shown. They should be made one foot deep, and of good, sound plank. The pipes must be entirely shut in, so that the greatest heat in the house will be under the frames; but there should be small doors placed along the entire length, opening into the passage ways, which may be opened to let the heat escape into the house when necessary to raise its temperature, or to lower that under the frames. The passage ways between the beds should not be less than two and one-half feet wide, and three feet is better. The frames should not be over four feet wide, as it would then be inconvenient to reach across them. A house eighteen feet wide will allow of three rows of frames, and two passage ways of three feet each; or the outside frames may be but three feet wide, and the center one, as it can be reached from both sides, may be six feet.

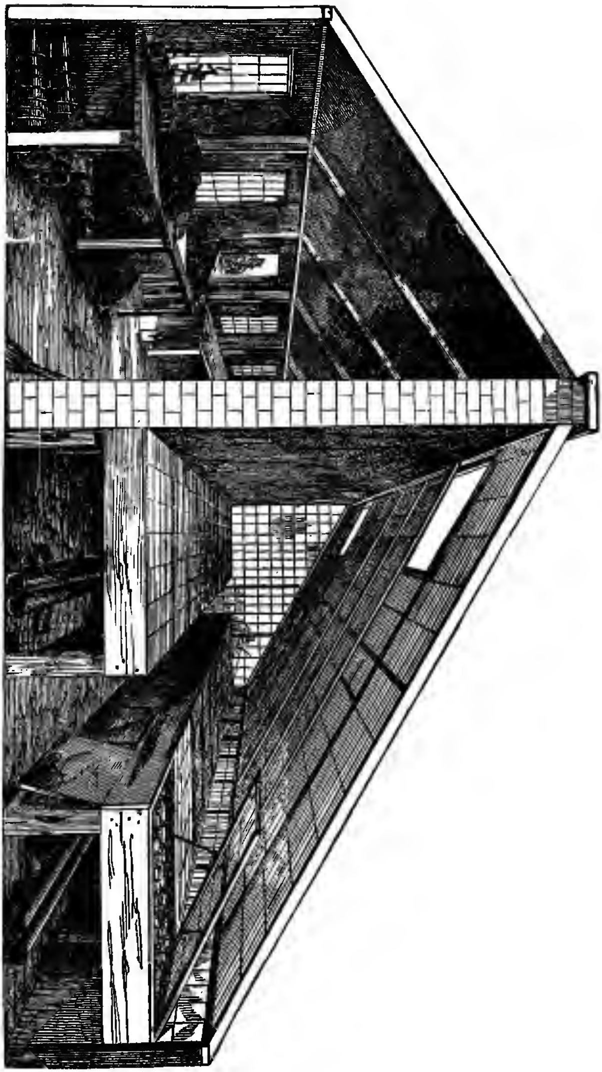

FIG. 13. LEAN-TO PROPAGATING HOUSE.

The places for ventilating the house may also be arranged to suit the convenience or fancy, but they should be mainly at the top. The sashes should be made in two sections—the upper one much shorter than the lower, and arranged so that it can slide down over the other, and leave an opening at the peak, as shown. Or the sash bars may be continuous from sill to peak, with alternate sections left for hinged ventilation; in fact, there is no end to the modern devices for ventilation of houses and their general construction, as may be found in such modern works as "Greenhouse Construction," by L. R. Taft, Orange Judd Co., N. Y., which will, of course, be consulted by those who intend erecting expensive structures of this kind. The short perpendicular sashes at the sides of the house may be made so that they can be opened; but this will seldom be necessary, for if the upper ones are opened the heat will pass off rapidly, and sufficient fresh air will find its way into the house through the small openings, of which there will always be more or less. There are hundreds of methods of ventilating glass structures; the object of all is the same, but these I have mentioned are the most simple and will answer every purpose.

The slope of the roof should be at an angle of from 35 to 45 degrees; the one shown in the engraving is at an angle of 35 degrees, or very nearly.

A Single-roofed House.—The single roof, or lean-to house, is often preferred, by propagators in the more northern States, as it is less exposed to cold, being frequently built against a sidehill or some building; where such a protection is not convenient, then a wall is built running east and west, or nearly so, and the roof is placed against this, sloping to the south.

Fig. 13 shows a lean-to house, with interior arrangements similar to that of the span-roofed house. The furnace and general storeroom is built against the north side, instead of at the end. This not only affords a protection to the wall, but gives a good-sized room for storing the compost, sand, etc. Four hot-water pipes pass the whole length of the house, as shown. The boiler and furnace are set in the room back of the wall, and the pipes pass through it into the house. The chimney may be built in the wall, or be carried up by its side. When brick or tile are used for flues, then a brick furnace is made in the wall, the greater part of it within the house; but the door should open outside, so that when opened the gas from the fire may escape into the furnace room. The furnace should be placed so low that the flue may gradually rise from it to the point where it connects with the chimney, and still not come too near the bottom of the cutting frames. If the furnace is placed with its top level with the surface of the ground within the house, and the flue be made to rise one foot, rather abruptly, as it leaves the furnace, it may then be carried fifty feet with not more than six inches rise, and still it will have sufficient draft. If the house is fifty feet long, the flue should pass under the frames at the front, and return under those at the back, the chimney being near the furnace.

The point where it enters the chimney should be at least eighteen inches above the top of the furnace. Of course, the more it rises the more rapidly the smoke and heat will pass. The size of the furnace will depend upon the size of the house, and also whether coal or wood is used.

CHAPTER VI.

CUTTINGS IN OPEN AIR.

Success in growing cuttings in the open air is often dependent upon the proper selection and preparation of the cutting bed. The soil may be loam, sandy loam, or fine muck, with an admixture of sand—the latter is one of the best, provided it is not too wet. Any soil that is retentive of moisture, but not really wet or swampy, will answer the purpose.

A soil at least eighteen inches deep is one of the requisites of a good cutting bed.

If the soil is naturally heavy and compact, a liberal quantity of sand, charcoal, or fibrous muck should be applied to lighten it, else it will become too hard and dry in summer, and the cuttings will suffer in consequence. A rich soil is also indispensable, for it is necessary that the cuttings should make a vigorous growth, that they may ripen a large portion of their wood and roots early in the season. This they can not do without a proper supply of food. But no fresh unfermented manure should be mixed with the soil, though it may sometimes be admissible upon the surface after the cuttings are planted.

If the soil is not naturally rich a liberal quantity (say enough to cover the entire surface four to six inches deep) of old, well-rotted barnyard manure, or a compost made of manure and sods, muck, leaves, or some similar materials, may be thoroughly mixed with the soil to the depth of one foot or more.

The cuttings will usually produce roots from the lower end first, therefore it is necessary that a portion of the enriching materials should be placed as deep in the soil as the roots will extend. An application of hard wood ashes will often be found very beneficial. It is always best to prepare the cutting bed in the fall, so that all the materials of which it is composed may become intermingled by spring.

Time to Make Cuttings.—In this latitude the fall of the year, soon after the leaves have fallen, is the best time to take cuttings from the vine, but where the winters are mild they may remain on the vine until mid-winter, or even later, without injury.

When taken from the vine, the wood may be cut into the required length, or, in other words, the cuttings may be made and put away in moist soil in the cellar, or buried in some dry place in the open ground, or the wood may be put away entire, and, if kept moist, the making of the cuttings deferred until spring.

Selection of Cuttings.—Cuttings should be made of the past season's growth—that is, shoots that have been produced during the summer are to be taken for cuttings in the fall. These are called cuttings of one-year-old wood. That which is strong and vigorous and well-ripened is the best, although the very largest does not always make the best cuttings, nor does it root so readily as that which is of medium size. All soft, spongy, and unripened wood should be discarded, as good plants are produced only from good, healthy wood.

Form of Cutting.—There is as great a variety of opinion among cultivators in regard to making long cuttings as there is respecting the form of those of a single bud. They are made of various lengths, from four inches to two feet. I much prefer a short cutting to a long one. A cutting of six or eight inches in length, when properly planted, will make as good, if not a better plant, than one of twice that length. The following is the method that I practice, believing it to be the best:

About the last of November or the first of December I select the wood for cuttings, and with a pair of garden shears cut it up into lengths of about six inches, leaving not less than two buds upon the cutting. If the wood is very short-jointed, a cutting of this length will have three or four buds upon it; if so they are all the better, as roots usually start from each bud, but are seldom emitted the first season in cuttings grown in the open ground, from the stem between the buds.

FIG. 14.

With a sharp knife smooth off the wood close up to the base of the lower bud, and cut off the top end about an inch above the bud, at an inclination, as shown in Fig. 14, which gives the form of a two-bud cutting.

A three-bud cutting is the same, with an additional bud between the two.

When the cuttings are all prepared, they should be put away in the ground where they will not be frozen or become too wet. I usually set them thickly in a shallow trench, then cover them up, leaving the top bud just above the ground, after which cover all up with coarse manure to keep out the frost.

So soon as the ground is settled in spring, fork over the cutting-bed, rake it level and smooth, then draw a line across it, place the back of the spade to the line and throw out the soil, leaving a trench nearly perpendicular at the side next to the line, and a little deeper than the cutting is long; then set the cuttings upright in this trench, unless they are more than six inches long—if so, incline them—placing them about three or four inches apart, and so deep that the upper bud will be one inch below the surface of the soil. Fig. 15 shows the position of cuttings in the trench before being filled. When the row is filled with cuttings, put in about two inches of soil, and press it down firmly around the base of the cutting; then fill up the trench evenly, just covering the upper bud, but do not bury it too deeply. This will leave a shallow basin of an inch in depth the whole

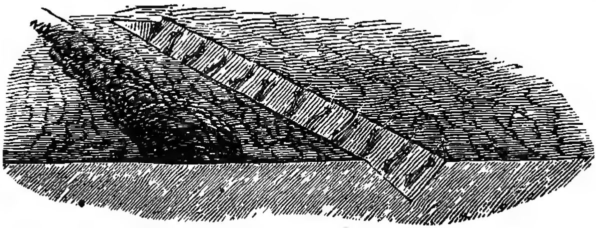

FIG. 15.

length of the row—the dotted lines in Fig. 14, above the upper bud, show the form in which this basin should be left. The rows of cuttings should be about two feet apart; the soil between the rows will be about two inches higher in the middle than at the rows. The time required for the cuttings to strike root and push into growth will vary considerably. If there is much rain and the weather is warm, then they will start quite early; but if the weather is cool they will often remain comparatively dormant until June, and even later than this, and then start and make a good growth by fall. The upper buds should be carefully preserved from injury, because it is from these that the shoots are usually produced. When the cuttings have made a growth of four or five inches, the ground should be leveled so that the upper buds on the cuttings will be covered an

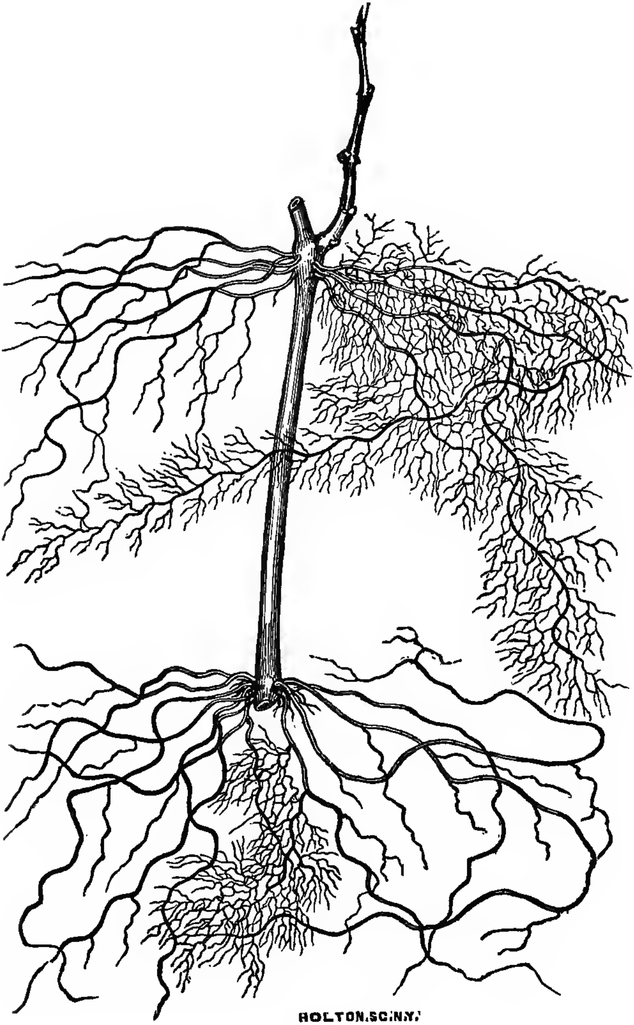

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FIG. 16.

inch or more; then, if two inches of mulch are spread over the ground between the rows, it will keep it moist and promote the rooting of the cuttings.

Roots from the lower bud will usually be produced first, but soon after the base of the shoot is covered, a

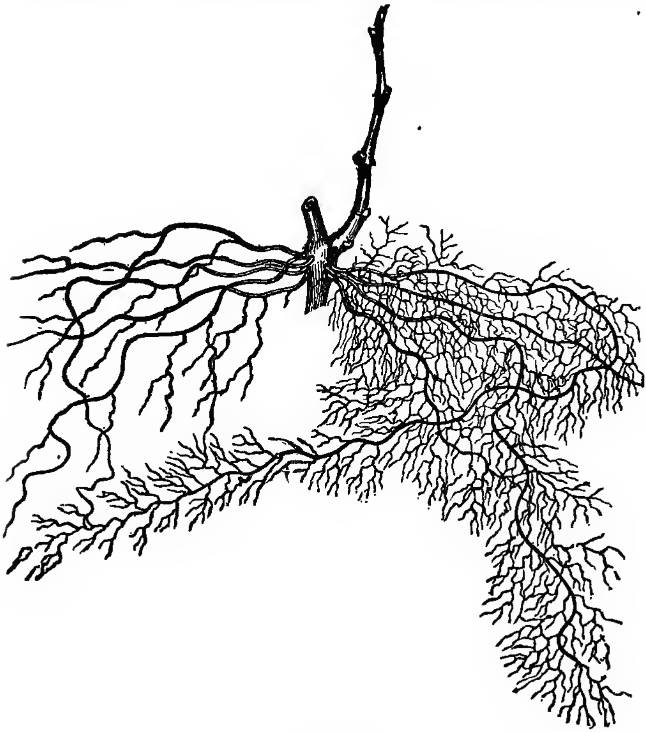

FIG. 17.

set of roots will issue from near it, which will assist the growth.

If the cuttings make a good growth—four to six feet is not uncommon—they should be tied to stakes, as this will promote the ripening of the wood. Fig. 16 is a fair representation of a two-eye cutting at the end of the first year. In this sketch the roots and top are necessarily shown much shorter, in proportion to the length of the cutting, than they were on the plant from which the drawing was made, and the small rootlets cover all the roots, while they are here represented on only a part. When roots have these small appendages attached to them in abundance they are called fibrous-rooted.

All vines, when grown in congenial soil, will have more or less fibrous roots, for it is through these that the plant derives a large portion of its food from the soil. They are often as minute as those shown in Fig. 16, and they are soon destroyed if exposed to the air.

When cuttings are grown in the above manner they are readily changed into one-eye cuttings, by severing the stem just under the upper tier of roots; this will give as good a one-eye plant as though it were grown under glass and from a single eye. Fig. 17 shows the plant after the lower section of the roots has been removed.

Growing plants in this way involves a waste of buds, and, moreover, cuttings are not so certain in the open air as in the propagating house.

It is very difficult to make some varieties grow from cuttings in the open air, while others do so readily. Some kinds require more moisture than others, and, if planted in a situation where they will receive an abundant supply throughout the season, they will often produce as strong plants as the others will in ordinary soil. It is also sometimes advisable, with those kinds that do not strike root readily, to plant the cuttings in the fall in the same manner as we have described for two-eye cuttings, then cover the bed with straw, or other material, so that it shall not freeze. In the spring remove the covering, leaving enough on the bed to keep it moist.

Where the soil used for the cutting-bed is naturally dry and porous, any or all the varieties may be planted in the fall, provided they are protected from frost during the winter.

That there are certain varieties of the grape that grow more readily from cuttings than others, in the open air as well as under glass, is well known to every vineyardist. But a variety that is very difficult to propagate by cuttings in the open air in one section of the country, may grow readily in another. Climate has much to do in this matter, and while I do not wish to convey the idea that there are certain circumscribed spots where a particular kind will grow from cuttings when it will not do so elsewhere, I wish to remark that the same skill that would produce a good plant of some varieties in Alabama, might fail to produce one in New York. Knowing this to be the fact, we are enabled to account for the diversity of opinion often expressed by different cultivators coming from widely separated sections of the country, for each speaks of his own experience or observation in his own particular locality; and while each may state the truth, their stories will not agree, and one may almost contradict another.

Mallet Cuttings.—The mallet cutting is usually made by selecting only the lower portion of the one-year-old cane, and by cutting through the two-year-old wood, leaving a small piece of it attached, so that the whole resembles a small mallet. Fig. 18 shows the

FIG. 18.

form of the mallet cutting. Where the one-year canes have been allowed to produce side, or lateral shoots, during the summer, these may be used to make mallet cuttings, the head of the mallet, or butt of the cutting, being composed of wood of the same age as that of the handle, or stem. The advantage derived from the presence of the piece of old wood is not, as is sometimes stated, because roots are more readily produced from it, but because there are several latent buds at the point of junction of the old and young wood; consequently, a larger deposit of cambium than where there is but a single bud. The piece of old, or large wood, assists in protecting these buds until roots are produced.

The number of cuttings that can be obtained from a vine is necessarily but few, as only one is made from each cane—unless laterals are used—and it will depend very much upon the mode of training, whether it will do to cut away the old wood for this purpose. The cuttings should not be made more than ten or twelve inches long; they are sometimes made much longer, but it is unnecessary, as too much wood will often prove injurious.

There are some varieties of grapes, for instance, the Delaware and Norton's Virginia, that grow much more readily from mallet cuttings than from the ordinary two or three-bud cuttings. If the laterals have been allowed to grow unchecked, and have produced canes of considerable size, they may be used, leaving a piece of the main cane attached to form the mallet.

The mallet cutting is, perhaps, the most ancient form of cutting. The Romans made their cuttings in this manner, and they were called *malleolus,* from the Latin *malleus;* hence our word mallet. The French vineyardists, in some instances, still adhere to this form of cutting, and with them they are called *crosetts.*

There are some vineyardists in this country who, to extend their vineyards, depend almost entirely upon the few cuttings of this form which they are able to get from their vines, and there is no doubt but that excellent vines may be grown from such cuttings; but it is equally true that other portions of the vine will, with proper care (though not always quite as readily), make vines equally as good.

It matters little what form of cutting is adopted, nor does any particular portion of the wood possess any superiority over another, provided it is thoroughly ripe and healthy. The requisites are: To keep its vitality unimpaired from the time it is taken from the vine until it is planted, then give the cuttings a position where they will secure plenty of heat and moisture, with a full supply of nutriment to sustain them when they begin growth.

The Callus on Cuttings.—A callus is that peculiar excrescence which is usually found on that portion of a cutting where the wood has been exposed by severing from the plant. The formation of the callus precedes that of roots, and is generally taken as a sign that roots are about to be produced. But it must not be supposed, because the cuttings have made the first move, that the second will as readily follow; because there are hundreds of plants, the cuttings of which, packed in damp moss in a warm room, will become well callused over, and still it is an extremely difficult matter to make the roots grow after removal.

Many inexperienced propagators seem to think that if they can only get the callus to form, and a few roots to start, the cutting is a sure thing, but it may fail later.

CHAPTER VII.

LAYERING THE VINE.

The propagation of the vine by layers is one of the most certain and convenient methods in use; and while the number of plants to be obtained from a given quantity of wood is not so great as in the other methods, yet the size of a one-year-old plant produced by layering will far exceed that produced in any other way.

A layer is a cutting which is left attached to the parent plant, and derives nourishment therefrom until it has produced new roots of its own. Much discussion has taken place upon this subject among cultivators of the grape, some asserting that in the first stages of the growth of the layered plant it was entirely dependent upon the parent for its food; consequently, the roots that are produced later in the season from the layer itself do not fully ripen, and are of but little value to the young plant when separated from the parent. For more than two thousand years layers have been recommended and condemned by different authors, and all have some plausibility in their arguments. But the facts are, that, when properly grown, layers make as vigorous and healthy plants as are produced in any other manner.

When vines are to be grown expressly for layers, they should be planted six or eight feet apart, in very rich soil, as the object will be to get a large growth of wood without regard to fruit.

The vines, when planted, should be cut down to the ground, or within a few inches of it, and only one cane be allowed to grow the first season, and this must be kept tied to a stake. In the fall or winter this should be cut back to within three or four buds of the last season's growth; this number of buds is left to guard against accident, but only two are to be allowed to grow.

The next spring the two buds that push the strongest are to be allowed to grow, and should be kept tied to the stake as before. If the vine this, the second season, grows strong, and makes a growth of from six to ten feet, it will do to commence layering it the next spring, at which time it will be in its third season after planting. But if it should not produce a strong growth, then one cane should be cut entirely away, and the other to three or four buds, allowing but two to grow, as before, and defer the layering until the fourth year. For there is nothing gained by taking layers from a vine until it is strong enough to make good plants. But so soon as the vine has made two strong canes of from six to ten feet long, whether it be the second or third year, it may be layered. Of course, vines may be layered earlier, or as soon as they have made canes one or two feet long, but the plants produced will be small and feeble, and not what would be considered first-class plants.

How to Layer the Vine.—If the wood that is to be cut off is wanted for cuttings, then the vine may be pruned in the fall; if not, defer the pruning until the last of February or the first of March. Select the largest cane for the layer; if it be ten feet long it should be cut back to six or seven feet, but if not so long then cut it back still more; then cut the other cane down to within three or four buds of its base. After the buds begin to swell in the spring (or even if they have grown an inch or two it is no matter), layer the cane in the following manner: Dig a trench from four to six inches deep, six inches wide, and of a sufficient length to receive the cane; now bend it down and fasten it in the trench by hooked pegs, or by laying a stone or two upon it. The bottom of the trench should be level and the vine laid flat in the bottom, and *not* turned up at the end as is sometimes recommended. The cane may be bent sideways, in a circular form, and it will be a benefit to it, as it will cause the buds to push more evenly than if laid straight, but that portion in the trench should still be as nearly level as possible.

Now let the vine remain until the shoots have grown from three to four inches, then select those that are wanted and break off all others; those that are allowed to remain should be as evenly distributed as possible through the entire length of the layer.

Four to six are all that should be allowed to grow on a cane six or seven feet long. If allowed to grow, every bud will make a plant, but not a good one; the less number, the better they will be. Fig. 19 shows the layer in the trench after the superfluous shoots are removed, also the roots as they will appear later in the season;

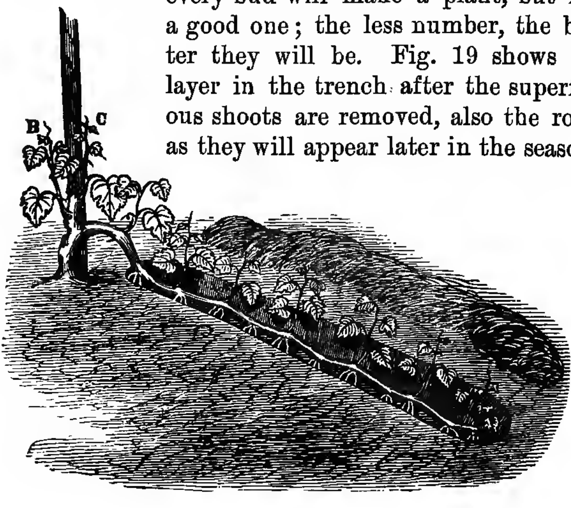

FIG. 19.

B, C, the young shoots starting from the buds on the main stem. The first roots push from near the buds, as with cuttings, but afterward they will start from between the buds.

When it has been decided what shoots shall be allowed to remain, then good stout stakes should be put down by the side of each; and so soon as the shoots are from six to ten inches high, they should be tied up. And at this time a little soil should be drawn into the trench; enough to cover the vine an inch deep will be sufficient. In a week or ten days an inch or two more may be put on, and so on at intervals of a few days, or at each hoeing, until the whole trench is filled up. If it is filled while the shoots are very young, it will cause the part below ground to rot. Each of the young canes should be kept tied to the stakes, and if a particular one takes the lead and appropriates too much of the sap to itself, it should be checked by pinching off the top.

The canes nearest the parent vine, and the one at the extreme end of the layer, will usually grow much more rapidly than those between; if so, they should be checked before they have gone so far as to weaken the other plants.

Hoe the ground often during the summer, or cover it with a mulch to keep down the weeds. The cane that was cut down to three or four buds should be allowed to produce two or three shoots; these are to be tied to the stakes shown in the engraving. Next season the same operation may be repeated, and if the vine has grown very strong, two canes may be layered instead of one. After layers have been taken from the vines two or three seasons in succession, it is best to let them pass over one season without taking any layers from them, for if layered every season they will soon become exhausted. Any vine that has a young shoot which can be made to reach the ground may be layered, but it is not advisable to take layers from vines that are planted for fruiting.

When only one vine is wanted from a plant, then a branch may be bent down into a short trench in the spring or fall, and covered up at the time, leaving only the end above ground. In this way a very strong vine will be produced the first season.

The layers may be separated from the parent vine at the end of the first season or the spring following. In taking them off cut them loose from the stakes, then lift them, using a fork instead of a spade, and proceed to cut them apart. First cut the layer close up to the parent vine, and then cut off that portion that was above ground and has no roots; the next cut should be between the first and second upright shoot near the first, and so on to the end, leaving those roots on each plant below it or toward the parent vine. I am thus particular in showing how the vine should be separated, because I have seen layers so separated that the roots left on them were nearer the top end of the layer than the shoot was, and the sap would have to reverse its course and descend the layered cane to reach the new vine. It will do so sometimes, but not readily. Where vines have been cut down quite low, or from any cause several canes have started from the main stem near the ground, these may all be utilized the following season for layers, and if quality is preferred to quantity, then each cane may be bent down in the form of a bow, into a short and shallow trench, and only a foot or more of it covered with soil, thereby securing only one strong layer from a single cane instead of several, as shown in Fig. 19. Many other methods are practiced, in making layers, but I think those described are the best.

There is one, however, which has lately come into use, that deserves a passing notice. It is that of making layers of the green wood in summer. An occasional good vine may be made in this manner, but, upon the whole, the practice is not only injurious to the original vine, but the plants produced in this manner are generally feeble, as neither roots nor wood are fully matured by the time they have to be separated from the parent vine.

CHAPTER VIII.

GRAFTING THE GRAPE.

The propagation of the grape vine by grafting is probably as old as its cultivation, and many of the modes practiced at the present time are accurately described in most of the ancient works on gardening and agriculture. But with all the information which we have derived from both ancient and modern authors, it still seems to be generally considered a rather difficult, if not uncertain method of propagation. On account of the peculiar structure of the wood of the vine, a lasting union is seldom obtained when grafted above ground, and is far from being certain even when grafted below the surface by the ordinary method. When we compare the benefits to be derived from grafting the vine with grafting the pear, apple, etc., it appears to be of little value, because the vine may be readily grown from cuttings of almost any portion of the wood, while the latter produce roots from cuttings only sparingly, even with the greatest care and under the most favorable circumstances, but they may be propagated very easily by grafting and budding. Thus it appears that nature has provided a way for the rapid multiplication of every species and variety of plants, but she has left it to man to discover the way and means. There are circumstances constantly occurring, under which it would be quite desirable to graft the vine; for instance, when we have a new and valuable variety which we wish to multiply as rapidly as possible; to do this we must produce wood for the purpose, and if we can produce wood more rapidly by grafting than by any other means at command, then it becomes very important to know how to perform the operation successfully. There are usually, in every garden where grapes are grown, inferior varieties which it is desirable to exchange for better, and if we employ grafting as a method of propagation, then these otherwise worthless vines may become valuable as stocks on which to graft better kinds; and if, by the use of these, we can make every bud to produce a shoot of from five to twenty feet in a single season, of larger and better wood than we can by any other means, and that, too, without the aid of any artificial heat, it becomes very important to know how to do it. Sometimes it would be desirable to change a whole vineyard from an inferior variety to a new and superior one, and if the operation is judiciously performed, it can be successfully done, as has been extensively practiced of late years in France, where they have used the strong growing, phylloxera-resisting American species as stocks upon which to graft the more susceptible but better wine grapes of Europe, and the time may not be very far distant when this will have to be practiced in California, where the exotic varieties are cultivated almost exclusively.

Everyone who has ever read the European works on grape culture, and especially those of France, must have noticed how much space is devoted to this subject of grafting, and it would not be at all difficult to gather enough material to fill a half dozen large volumes on this mode of propagating the vine. But when all these voluminous essays are condensed to practical limits, the difference consists mainly in the diversity of opinions of their authors in regard to the time and mode of performing the operation; and the success of the operator, with one and all, probably depends more upon his skill in manipulation than in anything else.

In grafting the grape, as with other ligneous plants, the operator may vary the process by cutting the stock high or low, square across or at various angles, also make the cleft in it long or short, deep or shallow, also vary the length of the cion, leaving upon it one, two or more buds; but so long as he keeps within certain limits he will succeed in proportion to the amount of skill brought to bear upon the operation. In the earlier works published on grape culture in this country, as, for instance, those of Adlum, Dufour and Loubat, the descriptions given of grafting the vine were mostly copied from the French authors, and these, in turn, followed earlier writers, especially Columella, a celebrated Roman agriculturist, who flourished in the first century of the Christian Era. But Columella refers to still more ancient authors, but claims that a great improvement has been made in grafting vines in his day, and especially in the implements used in the work, and this is about all that we can honestly claim in the way of progress in grafting the grape; for while our knives, chisels, saws and augurs are probably made after more artistic models, it is doubtful if they are better in material or temper than those in use two thousand years ago.

In mild climates, like those of Southern Europe, California and our Southern States, grafting vines may be done all through the winter months, and if the cions are carefully inserted they will usually become united to the stock by the time the sap begins to flow in spring. This idea of early grafting is a very ancient one, and the first time I had occasion I put it into practice. But our climate here in the North is too severe to risk the cions to exposure during the winter, and to avoid this I adopted the following mode of protection, my first experiment extending to only fifteen vines, but every cion united and made a most vigorous growth the following season:

In the fall after the leaves have fallen, and any time before the ground is frozen, say in October, November or December, varying according to latitude, dig away the soil from around the stock (which may be of any size, from one-half inch to two inches in diameter) to the depth of four to six inches, or on a level with the surface; then cut it off, and split in the ordinary manner for cleft grafting; make the graft of one eye with about four inches of wood, and insert it in the stock, being careful to have the inner bark of the stock and graft meet, then tie in the graft by winding around the stock some bass-bark or strong twine enough to hold it firmly in place. Fig. 20 shows the graft inserted and ready for tying. Next, throw in soil enough to fill up around the graft, leaving the bud just above the surface; then put a flower-pot (a box will answer the purpose) inverted over the graft, as seen in Fig. 21; then bank up, *d, d,* around the flower-pot to the top, but not over it; now put on some straw, *e,* say six inches deep, and cover the earth, *f,* over all. In this manner the graft is perfectly protected against the frost, and it has all winter to perfect a union with the stock, and by spring it is ready to grow. It should not be uncovered until the cold, freezing weather is over. It is necessary that a box or flower-pot should be placed immediately over the graft, so that when it is uncovered in spring the graft will not be disturbed by digging down to uncover it; and it also protects the graft from being injured by water running down it and getting in between the graft and the stock. I have sometimes used grafting wax for

FIG. 20.

covering the junction between the stock and graft, but having succeeded just as well without, I abandoned its use; besides, I have sometimes noticed that the wax injured the graft when it came in contact with it. Grafting clay may be employed with safety, but I do not consider it necessary to use anything but the bass-matt, and then put in the soil. The twine or bass-strings will usually become so weakened during the winter that they will give away when the stock commences to grow. One-year-old wood should be used for grafts, and only

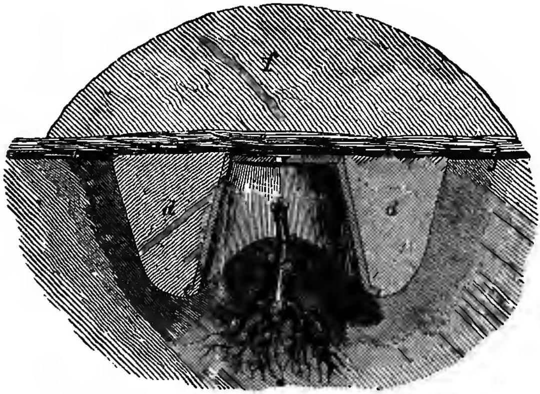

FIG. 21.

that which is firm and well-ripened. If the wood is very short-jointed, the grafts may be of two buds instead of one, but usually one is sufficient.

Grafts inserted in the fall in this manner will make almost as strong a growth as the original vine would have done if it had not been grafted; besides, the operation can be performed at a season when there is usually not so much business as in spring, and it requires no more skill in its performance than other modes of grafting. It can also be performed at any time during the winter, provided the ground is not frozen. But I prefer early in fall, as in that case there is more time for the union to take place; besides, the sap in the roots of the vine remains longer in the fluid state in the fall than in the top, as may be seen by examining the roots after the leaves have fallen, and when no sap is observable in the branches. This is owing to the fact that roots, in a great measure, are out of reach of the frost, which has checked the flow of sap in that portion of the vine above ground. All the roots of the vine are seldom in a perfectly dormant state, consequently the sap is always ready to flow upward into the branches whenever they are not frozen. The vine, as well as nearly all woody plants, continues to expand its buds during the winter months. And if there were no such action as this, then there would be no production of new fibers and callosities, which every practical horticulturist must have observed as taking place, especially upon the roots of trees and plants that have been transplanted in the fall. These facts led me to try the grafting of the grape early in the fall, and the results have been all that I could wish; for when the grafts have been properly inserted I have found them in the spring, without an exception, to be firmly united to the stock.

Within a few years following the appearance of this mode of fall grafting of the grape in the *Grape Culturist*, I received many reports, and from various sources, some condemnatory, while others recommended it, which was not unexpected, because similar results usually follow any of the many forms of grafting in use and at different seasons. If the grape is to be grafted for the purpose of securing continued benefit from a healthy, strong root, as, for instance, when employing "phylloxera-resisting stocks," then the cions should always be inserted slightly, if at all, below the surface of the ground; for if placed deeper new roots are likely to be emitted from the cion, and when this occurs the original stock roots are likely to fail to produce the desired results. It is natural for the sap to flow through the most direct and convenient channel, and this would eventually be the new surface roots emitted from the cion. Of course, it is no more difficult to bank earth around the newly set cion than to dig it away and graft below the surface; consequently, the grafter may vary the operation according with the object he has in view.

FIG. 22.

When there is a scarcity of stocks for grafting, an old vine may be layered, as shown in Fig. 19, and instead of taking up the layers the young canes may be grafted in the fall, inserting the graft as near the layered cane or roots as practicable. And when the grafts have made one season's growth they may be taken up and separated, or be again layered and several vines produced from each. But plants produced in this way will, when replanted, throw out new roots from the cion above the point of junction with the stock, and in a year or two the original root will usually die, and the plant will be no better than one raised from a cutting or layer. But in grafting the one-year-old canes the cleft or wedge-graft should not be used unless the canes have grown very strong, and are, at least, five-eighths of an inch in diameter; but instead of it, splice-graft them as follows: Select one-year-old wood for the grafts, as near the same diameter of the stock as possible; cut the stock obliquely upward and the cion downward, with a corresponding inclination, so that the two shall fit nicely together, care being taken that the bark on one side, at least, of the graft and stock shall meet exactly. Fig. 22 shows the manner in which they are united. Bind them snugly together, and proceed to cover, etc., as with the cleft-graft. But if more convenient, the small stock and cion may each be split, to form a tongue on each, and these fitted together as in the ordinary splice-graft used on small pear and apple stocks. It does not make much difference how the stock and cion are joined, provided they are so united that the sap can flow readily up through the cells of the wood. One-year-old well rooted cuttings may be employed as stocks, where it is desirable to multiply weak-growing varieties, or those which do not strike root readily from ripe wood cuttings. The cions may be inserted, as shown in Fig. 22, or as in Fig. 23.

Sometimes it is desirable to graft a whole vineyard, and if the vines are young and healthy it is perfectly practicable to do so; but if the vines are, as is often the case, old, stunted and diseased, it is better to dig them up and plant new ones. Because, if very large and old vines are cut down and grafted, a large portion of their roots is very likely to die in consequence of the severe check they receive by having all the top removed; and

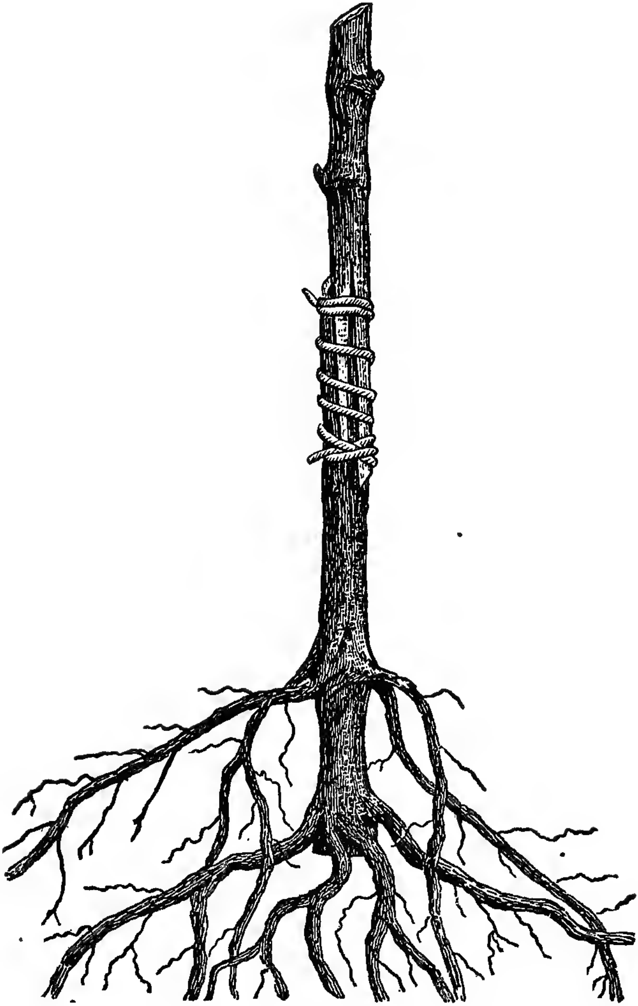

FIG. 23.

these dead and decaying roots will have a tendency to convey disease to the whole plant.

The time generally selected for grafting the vine is early in spring, before the vine starts, or after it has started and made a growth of a few inches, both of which I have found highly objectionable; for if grafted early, the operation must be performed several weeks before the vine starts, so as to allow the graft sufficient time to form a union with the stock before the latter starts, or else the excessive flow of sap will drown the graft. This early grafting is very difficult in a northern latitude, where the ground thaws out only a very few days before the sap begins to flow. But many practical and successful vineyardists graft their vines in late spring, or after the vines have made a growth of a few inches; but the wood used for the cions is cut in winter and stored in a cold and moist place until wanted. These dormant cions are inserted in the crown of the stock at or just below the surface of the ground, all of which only goes to show that success in grafting the vine depends as much upon the skill of the man who performs the operation as in the manner and time of doing it.

Inarching Vines.—This method of grafting differs only from the former in the manner of manipulation. It is not often practiced with vines, but may be whenever desirable, as, for instance, when other methods have failed. The vine to be multiplied by this process should be either planted out, near the vine to be used as a stock, or grown in a pot, and plunged in the ground near it when ready to perform the operation, which consists in cutting the bark and a thin slice of wood from the two canes to be united, and then bring the face of the two wounds together and bind firmly with bass or common twine. The inarching may be done in summer while the vines are growing, or when both are dormant in early spring. At the close of the season, or as soon as the two vines have become united, or grown together, the inarched vine may be severed just below the point of union, and the stock treated as usual with the ordinary splice or cleft-grafted vines.

Herbaceous Grafting.—This term is applied to the various methods of grafting vines while they are in a green, or growing condition, but it is seldom practiced in the vineyard or open air. Vines grown under glass in a close, warm and moist atmosphere may be grafted quite successfully by this mode, but in the open it is quite different, and I doubt very much if it can be practiced with any degree of success, although a few cions may occasionally be made to grow if kept shaded and freely sprinkled with water.

Grafting Machines.—The French vineyardists seem to have a fondness for inventing machines for grafting the grape and other ligneous plants, besides various forms of gauges, chisels, knives and other implements. Most of these machines are for inside work, and of no special value for facilitating grafting in the vineyard. The best thing of the kind that I have seen and tried is the "Wagner" saw and knife, an American invention which has been on sale for some fifteen or more years. It consists of two small saw blades set in a handle, these being used to saw a cleft in the severed stock of about the right width to receive the cion. Another part of the machine is made with two thin knife blades affixed to a lever, and with these the cion is cut or shaved to the requisite size to fit the cleft made with the saw in the stock. It is quite an ingenious contrivance, and practical withal, but I prefer a good sharp knife, chisel and wedge, to this or any other grafting machine that I have, as yet, used or seen described.

CHAPTER IX:

HYBRIDIZING AND CROSSING.

These are operations that should demand the attention of every one who undertakes to produce new varieties; for when artificially performed, improvements are more certain than if we depend wholly upon the natural variations occurring in vines grown from seeds, which have not been influenced by artificial fertilizing.

Many of our best varieties of grapes, as well as other fruits, owe their superiority, in a great measure, to the careful manner in which the flowers of the parent plant were fertilized.

The two words, hybridizing and crossing, are used indiscriminately by many writers in this country, who follow the European custom of calling every plant that shows a mixture of two varieties a hybrid. This is an error which we should avoid, for although the mode of operation in producing them is, in both instances, precisely the same, the results are entirely different.

A hybrid grape, properly speaking, is a mixture of two distinct *species*, not of two varieties of the same species. For instance, if we should take a Concord grape, which belongs to the *Vitis labrusca* species, and the common frost grape (*Vitis cordifolia*), and by fertilizing the one with the other, produce a plant with the characteristics of both parents, we should then have a proper hybrid. But if we should fertilize the Isabella with the Concord, we would have a *cross* between two *varieties* of the same species. Hybridizing, then, is the mixing of two *species*, and crossing, or cross-breeding (as it is termed), is the mixing of two *varieties*.

True hybrids are generally forced productions, but cross fertilizing is constantly going on naturally among nearly all cultivated plants.

During the last few years many new varieties of grapes have been brought to notice that are claimed to be true hybrids, and, doubtless, many of them are; but it is to be regretted, for the cause of science, that nearly all of these are, in part, a mixture of the varieties of *Vitis labrusca*, or its direct offspring; for of all the known native species, this is the most variable, producing, of itself, without being fertilized by other species or varieties, almost every conceivable shape, color and quality of fruit, as well as a great variety in leaf, stem and growth.

I think that I may safely assert that until some other varieties and species have been operated upon than those heretofore employed, but little reliance can be placed upon the assertions that are constantly being made about this or that grape being a true hybrid.

We know that plants in a state of nature generally perpetuate their kinds and varieties with great uniformity. Yet a slight change is sometimes observed, and it has been upon these variations that pomologists and florists have mainly depended, as the starting-point from which they produce their innumerable varieties.

The effect produced, by change of soil and climate, upon plants, when removed from their native habitats, has long been observed, and their variations turned to valuable account. Although these changes have been slow, yet by their careful selection and preservation we are indebted for most of the valuable fruits and flowers now in cultivation.

When plants are removed from one country to another, and become acclimated, the effects of this change will sometimes show itself in the seedlings grown from them, in a distinct and wonderful manner, so much so that some are inclined to think that it is the result of accidental hybridization. These phenomena lead many to believe that they have a hybrid variety, when it is only a variation produced by natural causes.

If we have a number of fruits which reproduce themselves without variation, it is not positive proof that they are distinct species. But it only goes to show that the natural forces of the plants are perfectly balanced.

We see this principle fully illustrated in the different breeds of cattle, sheep, etc, which are descendants of an original species, but are now divided into breeds, as they are termed, each of which perpetuates its distinctive features, unless some disturbing cause is allowed to interfere with their natural characteristics.

The case is very similar with plants; for we often possess varieties that have all their functions so fixed and balanced that they reproduce themselves from seed, generation after generation, if not disturbed by being brought into close contact with other and different varieties of the same species, or by a too great change of soil, culture or climate. But when there has been a disturbance of these forces, either by hybridizing or cultivation, and the functions of generation have been disarranged, then variation begins, and it becomes difficult to decide whether hybridizing may or may not have produced this change.

Suppose we fertilize the Concord grape with the Sweet Water, and the result is a white variety; would the simple fact of its being white be a proof that hybridizing had been accomplished? No, not at all; for there have been plenty of white varieties raised from the seed of the Concord, without its being brought in contact with any white kind. I have, myself, raised many white varieties of the grape, from both red and white parentage, without any attempt having been made at cross fertilizing, the change in color being due to the natural variation, or the effect of cultivation.

To convince us that hybridization has actually taken place, we need to see more than one of the prominent characteristics of both parents mixed in the offspring.

Again, if the offspring should appear to be only a reproduction of the mother plant without variation, it would not prove that the hybridizing process had not been effectual. But it would only show that there was a predominant power in the mother plant to reproduce itself, and the influence which the artificial fertilizing had produced was entirely hidden in the present generation of seedlings, but in the next generation it might show itself distinctly.

A good test to determine whether a plant is a true hybrid, or a mixture of two species, is to plant a quantity of its seeds; a portion of the seedlings thus produced will be pretty sure to show more prominently than others some of the characteristics of one or the other of the parents; or, in other words, the mixture will again separate, and a part will return each to its original progenitor.

There are, at the present time, a very large number of varieties in cultivation, claimed to be, and probably some are, true hybrids, either between native species, or between some of these and the foreign (*Vitis vinifera*) varieties, but those which show the least signs of hybridity, like the Rogers' Hybrids, have thus far proved to be the most valuable, and while this may be rather discouraging to some of our hybridists, still there is a chance that further trials may yield better results.

The world cares but little how a thing is produced, or where it is from, but is only interested in the results. Our greatest danger, as cultivators, lies in the fact that partial success will often direct our thoughts into a region of false theories, from which it is difficult to extricate ourselves without unlearning all that which we have previously learned.

In all our efforts at hybridizing, attention should be given to the adaptation of the plants to the circumstances under which they are to be grown.

If it is our object to produce a plant for this latitude, we should avoid, if possible, crossing with a variety that ripens late, or is otherwise unsuitable. The aim, in all our operations, should be to develop those qualities that are most valuable, and discourage those that are not; for these inter-crossings will often produce an individual variety more valuable to us than either of the parents. Again, we may cross two superior varieties, and the result will be a kind that is very inferior. But it is this very uncertainty that makes the operation so fascinating. If we could know exactly what the results of our labor would be, it would be robbed of half its charms.

Mode of Operation.—That we may proceed understandingly, let us examine the blossoms of the grape. But in the accompanying illustrations the flowers are shown much enlarged. Fig. 24 shows a flower as it is expanding; A shows the five petals cohering together, as they are lifted up and cast off by the stamens; the petals do not open, as in the rose, lily, and most other flowers, but drop off without expanding. Fig. 25 shows the flower after the petals are gone; the five stamens are now surrounding the center of the flower; the little knobs at their summits (B) are called anthers, which produce a fine dust, called pollen—this is the fertilizing material which we wish to control. Soon after the flowers open, or the falling of the petals, this pollen is carried by the air or insects to the stigma (C), which is the terminal point of the pistil, placed in the center of the flower. The surface of the stigma is covered with a viscid substance, to which the pollen adheres; and so

FIG. 24.

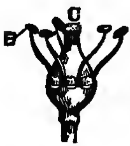

FIG. 25.

soon as the pollen lodges there it penetrates the stigma, and passes down through the pistil to the ovules, or undeveloped seeds. Now this operation goes on without the assistance of man, in all perfect flowering varieties of grapes; but when we wish to cross or hybridize a variety, we fertilize its stigma with the pollen from another plant, and prevent the pollen of the flower fertilizing its own stigma. To do this, so soon as the flowers open we cut off the anthers with a small pair of scissors, leaving the flower, as seen in Fig. 26 (D, stamens with the anthers removed); then take the pollen from another variety, and dust it over the stigma. This last operation is performed with a fine camel's-hair pencil. Suppose we wish to produce a cross between the Eaton and the Delaware, which would certainly be very desirable, as the former is very large but not remarkably good, while the latter is small but most excellent; and suppose we choose the Eaton for the fruiting parent. Now, it is very desirable that they should come into bloom at nearly the same time; but if they do not, it is positively necessary that the one to be fertilized should be the last to bloom; for the pollen can be kept good for a few days by cutting off the anthers when in a proper condition, putting them in fine, soft paper, placing the whole in a bottle, and corking it up until wanted. When the plant, the pistil of which is to be fertilized, comes into flower, it can not be retarded, and the operation must be performed as the blossoms open—although the period of blossoming may be hastened or retarded if the vine is operated upon early in the season for that purpose. When the Eaton shows signs of flowering we should watch it closely, and so soon as a flower drops its petals the anthers should be immediately cut away, and some pollen from the Delaware applied to the stigma. Operate upon every one that is sufficiently

FIG. 26.

advanced to admit of it, and then inclose the entire bunch in a gauze bag, to prevent insects from bringing pollen from other flowers, which they often do, and thereby interfere with our operations.

If a portion of the flowers were operated upon, say at ten o'clock A. M., by three or four in the afternoon another set will be open, at which time they should be fertilized in the same manner, and more pollen should also be applied to those operated upon in the forenoon, as they may not have absorbed that first applied.

The flowers do not open all at one time, neither is the stigma always fertilized by the first application of pollen; but it should be repeated a number of times during several days. When the fertilization has been complete, the miniature grapes commence swelling, and their growth proceeds rapidly.

The gauze covering should be removed so soon as all the flowers on the bunch show that they have been fertilized. Mark the bunch, and take care that no worm or insect injures it during its growth.

It is best to thin out the flowers before they open; cut away at least one-half the number, as it will be more convenient to operate upon those left. Besides, the berries will have more room to grow, and will be larger and mature better than if all were left on.

When the fruit is ripe, gather it, and proceed the same as recommended for seedlings, in the preceding chapter, being very careful not to make your seed bed where other grape seeds may have been scattered. Many a new grape owes its origin to seeds that were sown accidentally, and which grew instead of the ones that were planted purposely. In fact, a very large proportion of the varieties in cultivation are really accidental seedlings, although the introducers and discoverers may have claimed to have raised them from carefully hybridized flowers. In gardens where grapes are grown and eaten the seeds are widely scattered, and often grow, producing plants in great numbers. To be positive about results requires more than ordinary care and vigilance on the part of those who conduct experiments, in the production of new varieties, whether of grapes or other fruits.

CHAPTER X.

TRANSPLANTING.

Vines, whether grown from cuttings in the open ground or under glass, will often require one season of nursery culture before being planted in the vineyard. In such cases they should be transplanted from the cutting-bed, or, if grown in pots, they should be taken out, the earth shaken from the roots, the tops and roots shortened, and then planted in the nursery. This rule does not apply to well-grown layers, nor to extra large one-year-old cuttings, but only to such vines as are usually produced in nurseries. The benefits derived from transplanting young vines should not be overlooked. Vines, for instance, that are grown in pots, generally have a mass of roots that are crooked and distorted by being confined in a small space, and which need to be separated, their ends cut off, and sometimes a portion of them taken out entirely, and then planted where they can have special care, such as mulching, watering, etc., or they will make but little progress. It is much more convenient to do this when planted in a nursery than when scattered over a vineyard. Of course, when referring to the transplanting of vines raised in pots, it is not to be supposed that they are disturbed while growing, but only when ripened off in the autumn by cold and frost.

A large portion of the vines that are produced from cuttings in the open air will have but few roots, and sometimes these will be nearly destitute of small branching ones; but if they are taken up and have their roots shortened, and are planted again, they will throw out a number of roots from each of the original ones. The same remarks apply to one-bud cuttings in open air.

But the most important result derived from the nursery culture is, that the vine becomes sufficiently strong the second year to allow it to be placed at the proper depth when planted in the vineyard. This cannot be done with small one-year-old plants without detriment to their future growth. To be sure, they can be planted in the bottom of a shallow trench, which may be left open and not filled up until they have made a strong growth; but this will require extra care in cultivating; besides, in most soils these trenches would have to be cleaned out after every heavy shower. Vines may be left in the cutting-bed until they are two years old; some cultivators do so, but they do not make so good plants as when transplanted. Sometimes they are left there for several years, or until they are wanted for planting or selling; but such plants are of little value after the second year, as the roots are usually so long that it is impracticable to take them up entire, and they are cut off, leaving all the fibrous roots in the ground, and the remaining roots are so old that they possess but little power to produce new fibers. Had they been transplanted they would have been furnished with an abundance of fibrous ones. For these and other reasons I believe it is better to transplant the one-year-old vines from the cutting-beds or pots to the nursery, preparatory to their final planting in the vineyard. The soil for the nursery should be in the highest state of cultivation, containing all the manurial ingredients necessary for the growth of the vine, in addition to being deep and thoroughly pulverized. It is expected that while the young vines are in the nursery, not only will their roots be improved, but their general character will be so developed, that a proper selection can be made when they are transplanted into the vineyard, so that plants of equal vigor may be planted in the same row, and every vine upon the trellis may be in an equal state of forwardness, so that each step in the system of training may be applied to all the vines at the same time. This is of the utmost importance, if anything like neatness and uniformity is to be obtained in the vineyard. But it is difficult to secure this if one-year-old vines are planted, as at that time their real vigor or weakness cannot be readily determined.

To prepare the vines properly for the vineyard, they should be carefully taken up in the fall of the first season, and "heeled-in" in a cool cellar or in some dry place in the open air. They should remain in this situation until spring, when the ground has become sufficiently dry to work easily; but the earlier they can be planted, provided the ground is in suitable condition, the better. When taken out for planting, the roots should be shortened at least one-third, and, if very long —say two feet or more—then they may be cut back one-half, as it will not only be more convenient to plant them if shortened, but the plants will be benefited.

The plants should be kept under cover while being trimmed, and the roots kept moist and out of the wind, which would soon destroy the small fibers and injure the large ones. The trench in which the vines are to be planted should be dug before the vines are taken into the field.

Draw a line across the plot of ground to be planted, and dig out the soil, as shown in Fig. 27; this is eighteen inches wide, and twelve inches on one side and five or six on the other, the bottom being slightly oval; the soil is thrown all upon one side. When a number of trenches are ready, bring out the vines and plant them in the following manner: Place the vine in the trench upon the shallow side, and spread out the roots toward the opposite side; then throw on soil enough to hold them in place, and cover them; then put in another vine in the same way, setting them so far apart that the roots will not crowd; twelve to eighteen inches will usually be sufficient.

One person may plant, while another fills up the trench. When one trench is filled, proceed in the same way with another, always being careful to have each trench dug descending the same way, so that the vines will be uniformly on either the right or left side of the

FIG. 27.

trench. Then when the vines are to be taken up in the fall, it will only be necessary to examine one vine, to ascertain on which side the greater part of its roots is to be found; and the workmen can then proceed systematically, for they will know just where to dig, and thus be able to avoid injuring the roots. The rows of vines should be four feet apart, which gives plenty of room to work between them during the season. When the vines are planted and the ground about them leveled off evenly, they should be cut down close to the ground, and a good strong stake six or seven feet long be put by each. That portion of the stem which is left generally has more than one bud upon it, each of which may push into growth, but usually only the upper bud will start;

but if more than one should grow, the strongest only should be allowed to remain, and when this has grown a few inches it should be tied to the stake. This tying will have to be attended to at least once a week throughout a greater portion of the season. The laterals also must be pinched back as often as they start, leaving one

FIG. 28.

leaf the first time, two the next, and so on; but usually two stoppings will be all that is necessary.

As the stopping, or pinching off, the ends of the laterals constitutes a greater part of what is termed summer pruning, and as I shall have occasion to refer to it frequently in the following pages, the reader should fully understand what is meant by *laterals*, and their mode of treatment, as it is nearly the same upon vines in all stages of their growth.

Fig. 28, E, represents a portion of a vine in summer. Now, while this vine is growing, it produces young branches from a bud near the axils of the leaves; that is, from that point where the leaves join the main stem; *f* shows one of these young branches, which is called a lateral; at the point where this lateral unites with the main stem there is also a bud. Now if this lateral were broken out entirely it might injure this bud, or cause it to push into growth; or if the lateral is allowed to grow unchecked, the strength of the vine is divided into so many branches that none of them will become strong or well ripened. To prevent this, and retain as many leaves for the elaboration of the sap as is necessary for the full development of the plant, we pinch off, with the forefinger and thumb, the end of the lateral at *a*, when it has made two or three leaves, taking off all but one leaf. If the vine is growing rapidly, the lateral will start again and produce a young shoot from the base of this leaf, and when it has grown a few inches it should be pinched off at *b*, leaving one more leaf; *c* shows where it would be stopped the third time, should it be necessary; *d* shows a lateral as it appears when first starting. This checking the growth of the laterals not only concentrates the strength of the plant into the main cane, but it prevents the formation of a large number of small, thin leaves, which are of no benefit to the plant, and are, of themselves, so feeble that they cannot resist disease like large and strong ones, consequently they are often attacked while others escape.

While I am fully aware of the fact that to raise vines in this way is rather expensive, and would scarcely yield a profit to the propagator, in these times of sharp competition and low prices, but I practiced it for many years with the best results; but vines at that time sold for about five times their present price. I still claim that it is the proper way of managing young vines, although it may not be a profitable one under all circumstances.

The usual system is to transplant the one-year-old vines into nursery rows, cutting off the young cane to within one or two buds of its base, and then allow the vines to grow the following season without staking or other care beyond that of keeping them from being smothered by weeds. Good strong vines are, without doubt, produced in this way, and it is, perhaps, the only one by which the propagator can expect to secure a moderate compensation for his labor.

When vines have grown one season in the nursery they ought to be large enough to be transplanted into the vineyard; but if not, then they should be cut down to within one or two buds of the last season's growth, and but one cane allowed to grow, as in the year before.

If, at the end of the second season in the nursery, the vines have not made a growth of from four to six feet, then we may rest assured that there is something radically wrong, either in the soil or the vines, and they should be dug up and either discarded altogether, or trimmed root and top, planted again in another situation, and treated the same as one-year-old plants. But if the vines have made a vigorous growth, then they are ready for the vineyard, and in much better condition for the purpose than they will be at a future time. Vines older than three years are seldom so valuable for transplanting as those younger.

When the vines have arrived at the proper size for vineyard planting, and so soon as the leaves have fallen in the autumn, they should be carefully taken up by means of the garden fork. Raise the roots as nearly entire as possible, for if any are to be shortened or to be cut entirely away it is better to have all before the eye, so that a selection can be made, than to do it with the spade and wholly by chance. When the vines are taken up they may be immediately planted in the vineyard, provided all the circumstances connected therewith are favorable; if not, they should be put away in the ground, where they will remain safely during the winter. This latter operation is called heeling-in.

Heeling-in.—The usual method of heeling-in plants, or laying in by the heel (roots), is as follows: Having selected a dry and protected situation, a trench is made in the soil a foot or more deep, and wide enough to receive the roots of the plants, and of any required length, the soil being thrown out upon one side. The plants are then set thickly together in the trench, with the tops in a sloping direction, and against the bank of soil thrown out of the trench; another trench is made

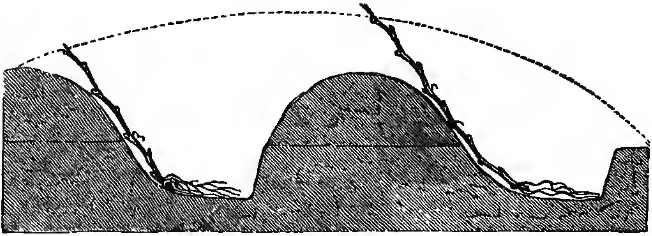

FIG. 29.

parallel to the first, and the soil taken from it is thrown into the first, covering the roots, and carefully filling in all the interstices between them. Press down the soil and smooth off the surface, so that water shall not lodge thereon. When one trench is finished, set the plants in the next, and proceed as before. When all is completed, dig a shallow trench around the whole, so as to carry of the water and keep the situation dry.

Fig. 29 shows the form of the trenches with the embankment against which the vines are placed. But the trenches are shown at a considerable distance apart; this, of course, is not as it would be in fact, because the first trench is filled up in making the second, so that the trenches are actually joined together side by side, and the vines in the two rows need not be more than a foot apart. The entire vine may be covered, if desirable, to protect the top from being injured by cold (the dotted line over both trenches, in Fig. 29, shows the form of the embankment when the whole top is covered), or the vines may be cut back before they are heeled-in; but in either case, if the whole vine is covered, it is best not to do it too early in the fall, nor let the earth remain on too long in the spring. It is also best to assort the vines before cutting off the tops, because we can better judge of the condition of the roots by the appearance of the tops than we can after they are removed. The roots may be abundant and large, yet if they are not well ripened they are of but little value, and it is not always an easy matter to determine their condition when coated with soil, as they usually are when first taken from the ground.

CHAPTER XI.

SOIL AND SITUATION.

When we take into consideration the wide extent of territory in which the grape is found growing, either in its wild or cultivated state, on both the Eastern and Western continents, we may well ponder over the oft-repeated assertion, that the vine does not succeed over the whole extent of any country, but only in certain circumscribed localities; and while we may admit its truth, we fail to comprehend the reasons why certain soils or sections of a country should be more congenial to the vine than others. Yet the fact that success does attend its cultivation in particular locations, while it entirely fails in others, is patent to every casual observer. Whether these failures are attributable to the injudicious selection of varieties, or to the mode of culture, is not always easy to determine. That the climate of both the Northern and Southern States, as well as that portion of the United States lying west of the Rocky Mountains, is congenial to the vine, is abundantly proved by the numerous varieties found growing wild over this vast region of country. No doubt there are particular varieties which are better suited to one section than to another, and that the same situation and exposure that would be most suitable for a vineyard at the South, might be the worst that could be selected for the North.

A situation protected from the cold north winds, so as to insure sufficient heat to mature the fruit, is always desirable in a cold climate; but in a hot one the heat may be so great as to exhaust the powers of the vine by a too rapid evaporation from its leaves, and it consequently fails.

Nearly all the writers on grape culture recommend the declivities of hills and mountains inclining to the south as the best exposure for a vineyard; and the next in order are the southeast, east, southwest, but never a north or a full western exposure. Virgil said, "Nor let thy vineyard bend toward the sun when setting," and these words are as applicable at the present time as they were two thousand years ago.

A full southern exposure is, no doubt, preferable in the Northern States, and if the land descends to the south, so much the better; but if very steep, it will cost more to prepare and keep in order than if it is level. While I admit that a sidehill is a very desirable location for a vineyard, I am quite certain that there are many situations equally good that are perfectly level, or nearly so.

I have often observed that the success of a vineyard-ist was attributed to his soil and situation, but never to the skill of the cultivator or to the varieties grown, and this, no matter whether his soil was light or heavy, or the situation low or elevated. Still, we know that soil and situation have often much influence upon the growth and quality of the fruit; for the instances of such an effect being produced are too common in Europe, at least, to allow us to deny its truth.

In selecting a situation for a vineyard, all the surroundings should be closely observed and taken into account. If the land has no protection from the north and northwest, see what the facilities are for supplying one either by walls or a belt of trees. [If trees are to be used, evergreens are best, and often the small trees may be had in the woods near by—we now refer to the Northern States.] See that the land is sufficiently elevated, thirty to forty feet, at least, above streams or ponds of water; for, if near the level of small bodies of water, the situation will very likely be subject to early and late frosts.

Large bodies of water are not so injurious as small; in fact, they are usually beneficial, as they absorb heat in such quantities during summer, and give it off slowly in the fall; this affects the surrounding country very materially, by preventing early frosts. In spring, the water being cold, it keeps the atmosphere cool for quite a distance from the shore, and thereby prevents vegetation starting so early as it otherwise would. This is probably one of the reasons why the cultivation of the grape has been so largely extended, of late years, along the banks of the Hudson, and around the smaller inland lakes of Central New York, and on the southern shores of Lake Ontario and Erie.

When the soil is sandy or gravelly, it will require an application of some organic material, either in the form of barnyard manure, muck or leaf-mold. The latter two can often be readily obtained, where the former, in any considerable quantity, would be out of the question, or would be so expensive that it would very much lessen, if not entirely absorb, the profits of the vineyard. There are thousands of acres of sandy or gravelly lands in the Eastern States, that would make the very best vineyards in the country, simply by applying the enriching materials that are to be found in abundance in their immediate vicinity.

Strange to say, these lands are now considered almost worthless, because barnyard, or commercial manures (as they are called), can not be had sufficiently cheap to make them profitable for cultivation. While a sandy soil may not naturally produce the most luxuriant growth, it is certain that it produces fruit of the richest quality. Such soils are moderately favorable to the growth of the vine, are easily worked, and do not retain an excess of moisture, as they are thoroughly underdrained by nature.

Volcanic, granitic and limestone soils are all excellent for vines, and as these are usually strong and rich they need but little more than a slight change in their mechanical condition, which is readily accomplished by plowing or trenching. And here let me remark, that very often the mechanical texture of the soil has more to do with success or failure, than do the ingredients it contains.

A moderately loose and friable soil, whether it be loam, sand, gravel, or the debris of rocky hillsides, especially if of a calcareous nature, are to be chosen, in preference to clay or muck. These latter may be somewhat reclaimed and made available by underdraining, trenching, etc., yet in a majority of cases they prove unsatisfactory in the end.

The soils in many portions of the Western States, and in some portions of the others, that have but recently been brought under cultivation, need no addition of fertilizing materials.

New soils are to be preferred to those that have long been in cultivation ; for it is extremely difficult to supply artificially to worn-out soils the lacking materials, in a form so perfectly adapted to the wants of plants, as that which they originally possessed. I am well aware that some agricultural chemists have endeavored to impress upon the minds of cultivators the importance of analyzing the soil, in order to ascertain what particular ingredients it may need, or what it may possess in too great an abundance to produce any particular crop or plant in perfection. And while I admit that chemists may sometimes determine when there is an excess of any particular constituent (which practical men will often do by merely looking at it), I have yet to learn that analytical chemists can tell how little of any particular ingredient is needed for any particular crop. An acre contains 43,560 square feet of surface, and if we call the soil a foot deep (and there are few plants that do not penetrate deeper than this), then there will be that number of cubic feet. A cube foot of ordinary soil will weigh from 75 to 100 pounds—we will call it 80 pounds—this gives 3,484,800 as the weight of an acre of soil one foot deep. There are circumstances of frequent occurrence when a farmer, by adding 100 pounds of some particular material to an acre of grain, will increase the crop twenty-five per cent. And certainly it is not reasonable to suppose, nor do I think that any theorist will maintain, that it is among the possibilities of chemical science to detect even a trace of 100 pounds of a substance in 3,484,800, yet plants will detect it.

I make these remarks because I have seen men, when looking for a situation on which to plant a vineyard, who were very particular to have the soil analyzed by some celebrated chemist before they would purchase or plant. I do not wish to depreciate the science of agricultural chemistry, for it has been one of the powerful auxiliaries in the advancement of agriculture, but I would warn those who implicitly rely on all the theories advanced, that they may ask too much of it, and thereby be led astray.

Preparing the Soil.—The manner of preparing the ground for a vineyard depends entirely upon the kind of soil, and its natural condition. If it is heavy and compact, the first step will be to underdrain it, either with stone drains or tile.

The number of drains required, and the depth to which they should be laid, will also depend somewhat upon the nature of the soil and the amount of water to be carried off. If the land has springs in it, then the drains should be placed so as to cut them off near their source, and prevent, as much as possible, the excess of water from spreading.

But soils containing springs, except they be gravelly, should be avoided, as they are, perhaps, the most unsuitable that could be selected. There are also many soils that are called dry that should be underdrained, especially if they are inclined to heavy loam or clay; not so much to carry off the water, but to aerate the soil—that is, allow the air to penetrate and circulate through it; for air always carries with it more or less heat and moisture, and if the mechanical texture of the soil is such as to readily admit air, then it will be more likely to be in a condition to transmit moisture rapidly, but not to hold a superabundance.

Drains are usually placed from twenty to forty feet apart, and three to four feet deep, according to soils, situation, and the crop to be grown on the land. For vines the drains should be placed deeper than for ordinary farm crops, else the roots will soon penetrate to and fill them. To describe the different kinds of materials used in draining lands, as well as the manner of laying, cost, etc., would occupy too much of our space, and we must refer those of our readers who wish to plant a vineyard upon soils that require draining, to those works that treat particularly on this subject.

When vines are to be planted upon steep hillsides or upon stony soils, the only thorough method of preparing the soil is by trenching. This is done by digging across the field to be planted a trench two feet wide and two feet deep—some recommend three feet or more; but if it is full two feet it will generally be deep enough, and deeper than nine out of ten do actually trench when they say three feet. After the soil has been thrown out upon one side of the trench, a parallel strip of soil, of the same width of the trench, is thrown into it, and by this means the soil is inverted, the top, or surface soil, being placed at the bottom, and in this way one trench is dug to fill up another, until the whole field is trenched over. The soil taken from the first trench will, consequently, remain on the surface above the level of the surrounding soil, and there is no soil to fill the trench last made. It is usual, on level ground, to take the soil that was dug out from the first trench and put it in the last; but to do this is often inconvenient, and I have yet to see a piece of land, of any considerable size, without a spot somewhere upon it where the soil thrown out of the first trench would not improve it by filling it up; and if the trenching is finished off upon the higher portion of the field, the trench last made may be filled up from the adjoining soil without injuring its looks. It does not matter where we begin to trench, whether in the middle or at one side of the field.

This inverting the soil, as described, is the simplest method of trenching, and is as efficient as any, provided the subsoil is not of a character so inferior that it will not be rendered suited to the growth of plants by being exposed a few months to the atmosphere. The subsoils of light sandy soils are often richer than the surface, as a great portion of the enriching materials that have been applied to the surface has been carried down by the rains, to the subsoil below. But the natural richness of the subsoil when thrown upon the surface should seldom be depended upon, but manure must be added, and thoroughly incorporated with it before planting.

There are many circumstances in which the soil may be inverted to the depth of two feet with benefit—such as sandy or light loamy soils, or where manure can be liberally applied, and a year be given for the amelioration of the condition of the subsoil before planting. Where these circumstances do not exist, it is best not to throw the subsoil on top, but to mix it with the surface-soil at the time of trenching.

To do this thoroughly and conveniently, the workmen should stand in the trench, and keep an open space at the bottom on which to stand. Then, by digging down the bank and throwing it over against the opposite side, break up the lumps at the same time; the soil may not only be thoroughly pulverized, but the surface-soil and subsoil will become thoroughly intermingled.

A five-tined spading-fork is the best implement for trenching, unless the soil is very hard and stony; in such cases the spade and pick must be used.

Although trenching is indispensable upon very hard and stony soils and upon steep sidehills, on level situations or those with only a moderate inclination (and they are always preferable) the plow may take the place of the spade, and it will very much lessen the expense of preparation. If the soil is stirred to the depth of from fifteen to twenty inches, which it may be by using a subsoil plow, it will be as deep as is really necessary to insure a good and healthy growth of vine.

I no not believe that it is desirable to encourage the roots to penetrate to a great depth, especially in a northern climate, for when the roots penetrate deeply they do not come into full action until late in the season, and they also continue to act late in the autumn, thus preventing the early ripening of the wood.

If the soil is not naturally rich, spread the manure upon the surface before plowing, then turn it under with the surface-plow, and let the subsoil plow follow in the same furrow, breaking up the subsoil. After the ground has been all plowed over in this way, then cross-plow it in the same manner; this will insure a thorough breaking up of the soil and mixing of the manure with it. When the land has been both plowed and cross-plowed, if it is then gone over with the cultivator it will still benefit it very much, as it will break to pieces the lumps which will be left unbroken after even the most thorough plowing.

We should always endeavor to make thorough work in the preparation of the soil before planting the vine, for it is not an ordinary crop that we are to plant, nor one that necessitates a seed-time to each harvest, but it is one that requires but one planting in a lifetime, yet it will reward us with many harvests.

There are very few soils that a person of good judgment will select that will need any further preparation than that which can be done with the plow, with the addition, perhaps, of underdraining. Manures, of course, must be applied where the soil is not rich enough without them.

Manures and their Application.—The quantity of manure required by an acre, to fit it to produce a strong and healthy growth of vine, cannot be known until the fact has been ascertained by actual experiment upon each individual piece of land, and the vineyardist only can be the judge in the matter. But it is always best to be on the safe side and put on enough, because the vine will soon exhaust the surplus, if any; while if too little is given, a complete failure may be the result.

As vines seldom starve to death the first season, although their growth may be small and weak, if supplied with a sufficient quantity of the proper fertilizers the second year, they may not only live, but finally become strong and productive, at a loss to the cultivator of a year's growth, the penalty for his ignorance or negligence.

In all sandy, gravelly, and light loam soils there is usually a want of organic materials, and that want must be supplied by applying muck, leaves, leaf-mold from the woods, sods, or barnyard manure, or it may be supplied by growing clover or some other similar crop and turning it under while green. When muck or leaves are used, it is best to compost them with barnyard manure. This may be done by spreading the materials over the barnyard a foot deep, and then spread the manure over it and let the cattle tread it in; and when the manure has accumulated to the depth of six inches, spread on another foot, and so until it is three or four feet deep; then it should all be forked over and mixed together. If the whole is under cover it is better; but it is not very essential, unless manure is very scarce and valuable. The muck absorbs all the liquid portions of the manure and prevents waste, and a compost of three-fourths muck or of the other materials named, and one-fourth barnyard manure, is more valuable for a light soil than if the whole amount were barnyard manure.

When it is not convenient to make the compost heap in the barnyard it may be made anywhere in the fields, by first laying down a foot in depth of any of those materials, and then drawing out the manure and spreading it over the surface, putting on alternate layers until a sufficient quantity is obtained. The compost heap should be kept level on the top, or a little inclined toward the center, so that it shall receive the water that falls upon it. This will cause it to decompose more rapidly than if the water did not penetrate it.

The compost should be frequently turned over, so that it may become fine before it is wanted for use. It will seldom be fit to use in less than six months, and it is better to let it remain one year. Ashes may be applied to the compost at any time, with benefit; also ground bones, charcoal, horn shavings, offal from the butcher's, refuse from rope walks, woolen and cotton factories, etc.; in short, almost any such materials may be mixed in; they are all good, but not positively necessary, nor worth while spending any great amount of money or time to obtain. Lime and ashes are both very beneficial to light soils, but they may be applied alone, and upon the surface of the soil after the vines are planted. Lime, especially, should be applied in this manner, as it descends rapidly into the soil and needs no mixing with it; besides, when applied upon the surface it will often assist in the destruction of the larvæ of insects, in the decomposition of vegetable matter, etc. Shell lime is considered the best, but the difference is so slight that it will not pay to transport it any great distance if stone lime can be had near at hand.

The compost should be spread upon the soil and plowed in, as has been described, before the vines are planted.

The quantity may vary from fifty to five hundred two-horse wagonloads per acre, but it is not judicious to put on too much at first, as it will cause a rampant growth; it is not desirable to produce such, as it will be troublesome to keep it in check when we come to train the vine. It is better to apply sufficient to give the vines a good start and apply more in after years as needed.

There are sections of the country where there are sandy and gravelly soils that are well suited for vineyards, but barnyard manure can not be obtained. If either muck, mud from streams, or leaf-mold can be had, they may be used without the barnyard manure, but they should be placed in heaps where they can be forked over occasionally, so that they will become sweetened, as it is termed, before using; and it is well to mix a quantity of lime or ashes with them, to assist the decomposition. A bushel of salt to every ten or fifteen loads may also be added with benefit.

Soils that are more compact, such as are called heavy loam, or approaching a clay, do not need so much of the organic materials as those called light soils, as most of them contain more or less of them; but they require thorough pulverizing; after which, if a good dressing of well-rotted barnyard manure is added, little more is needed before planting the vine. Any soil that will produce a first-rate crop of corn or potatoes is rich enough for vines. A few shovelfuls of manure, or two or three quarts of bonedust may be mixed with the soil when the vine is planted, especially if the vine is not one of the strong growing varieties. And it may not be out of place to mention here that there is a great difference in the growth of varieties, and the soil should be prepared with reference to this fact. Some kinds would entirely fail upon soils which would be rich enough for others. If we should make the soil rich enough to produce a strong growth on a feeble growing variety, and then plant it with a strong growing one, there would not only be a waste of materials and labor, but the rampant growth produced would be an abomination to the vineyardist when he came to train his vines; for he not only endeavors to train them, but to control their growth.

Special Manures.—There are many kinds of manures known as "special," some of which are, no doubt, valuable; but where those materials which have been mentioned can be obtained, there will be no necessity of looking after the specially concentrated manures. Guano, poudrette, superphosphate of lime, etc., may occasionally be used with benefit, to give the vine a start when first planted, but it is doubtful whether it would be judicious or economical to depend entirely upon any of them to carry it through a succession of years. I have found fine ground bones to be a safe and not very expensive stimulant for the vine. I sometimes use one to two quarts to each vine when planting, mixing it with the soil immediately about the roots.

After a vineyard is planted, manuring must not be neglected; for the vine needs not only to be supplied with food at the start, but it will want feeding continually, if it continues to grow and bear fruit. How often it will need a supply the vineyardist must be the judge. All that is required is to keep up a healthy growth. Too much manure may increase the size of the fruit, but it will injure its quality. The manure may always be applied upon the surface, and worked in with the cultivator or hoe, but the plow should never be admitted into a vineyard, as it will cause more injury than benefit.

Frequent and regular top-dressings of manure are better than large applications at long intervals. Rank unfermented manures should not be used for this purpose, as they will often injure the flavor of the fruit; besides, they will more or less affect the health of the leaves

Upon very open and porous soils a mulching of leaves, straw, tan-bark, or similar materials will be very beneficial, but upon more compact soils it is better to keep the surface of the soil open by frequently stirring it with the hoe or cultivator, so that it will the more readily admit the air, and with it heat and moisture. When such soils become surcharged with water, as they frequently do during long rains, they will give off much of the surplus moisture if the surface is kept open and uncovered; but when they are covered with a mulch they retain too much near the surface, and the soil will become soured, and the surface roots be destroyed in consequence. With all the care that may be bestowed upon the vine in regard to soils, manures, etc., much will still depend upon the system of pruning and training adopted.

CHAPTER XII.

STEM APPENDAGES.

There are various appendages to the stem of the vine, such as spines, hairs, etc., which are of service to the botanist, as they assist him in determining the different species, varieties, etc. ; but those that are of the most interest to the practical vineyardist are the laterals, leaves, tendrils and buds.

The mode of treating laterals has been given in a preceding chapter, in which it was shown how they may become injurious or beneficial to the vine, according to the will of the vineyardist. Leaves are the most conspicuous appendage of the vine, and they are of the greatest importance, as it can not exist without them. They are sometimes called the lungs of plants, and many beautiful theories have been brought forward in accordance with the similitude. Their chief office appears to be to assimilate materials which are taken up by the roots, and to do this it is necessary that their surface should be exposed to light. The greater surface of leaves that a vine exposes to the sun, the greater power will it have to take up liquids from the soil, and with them those constituents which go to make up the whole structure of the vine.

This being the fact, it can readily be seen how, by diminishing the number of leaves, we check growth, or *vice versa.* But it should be borne in mind that simply taking off a portion of leaves will not always actually diminish the strength of the vine; for instance, if they are much crowded, one portion may shade the other, and all may be small, feeble, and of little use. If a part of these are removed, those remaining expand, and one leaf may become of more importance to the vine than a dozen when crowded.

This is why we pinch off, thin out, etc.; for the results of these operations show that, when under cultivation, vines will produce a larger number of leaves than are necessary to secure the proper development and health of the plant.

Although the general appearance and structure of vine leaves are very similar, yet there is a great difference in the relative power of leaves of different varieties to withstand the various changes of climate, disease, etc.; and it is of the utmost importance that their full development should be attained in all cases, so that they shall not be affected by the ordinary changes of the temperature during the period of growth.

Forms of Leaves.—To mention even a hundredth part of the various forms of vine leaves would occupy too much of our space. But I have given the following illustrations for the purpose of showing the different characteristics of the leaves of some of the different species, and at the same time convey a better idea of the meaning of some of the terms commonly employed in describing the leaves of the different kinds, than could be done without engravings.

The leaves are necessarily shown much smaller than the natural size, but in doing so I have endeavored to preserve their most prominent features. In making the selections for the engravings from my sketch-book, I intended merely to choose those which were quite distinct; but since they were engraved I have found that, although inadvertently, I have selected those that are natives of as widely separated portions of the globe as I could have possibly wished, had I aimed at doing so. The leaf has two distinct portions—the expanded part, or *blade*, and the leaf-stalk, or *petiole*. The petiole is attached to the *base* of the blade, and the opposite point is the apex. The general outline of grape leaves is more

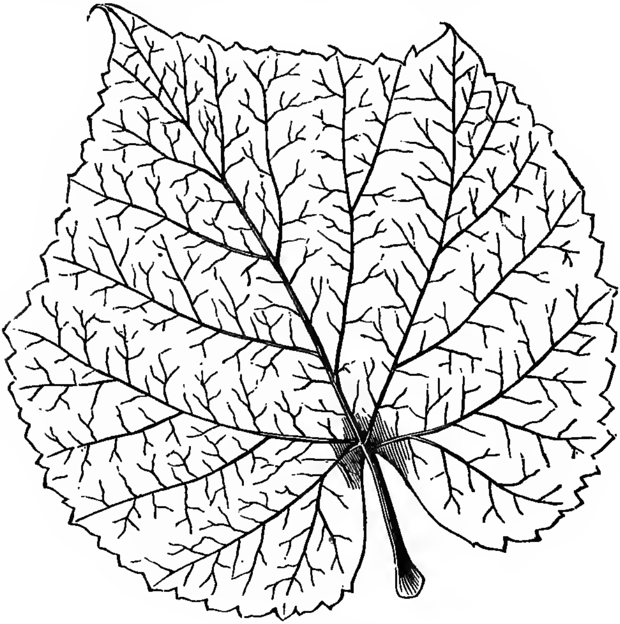

FIG. 30. THE OPORTO.

or less heart-shaped. The Oporto (Fig. 30) is round, heart-shaped; the Nebraska (Fig. 31) acuminate, or pointed-heart-shaped; while the Scuppernong (Fig. 32) is scarcely heart-shaped at all, but nearly orbicular. The edges of the leaves are variously notched, and these markings, as well as the general shape, are of importance in distinguishing species and varieties. It will be seen, by comparing the different figures of grape leaves, that the notches differ not only in shape, but in depth. These divisions upon the margin, when small, and shaped

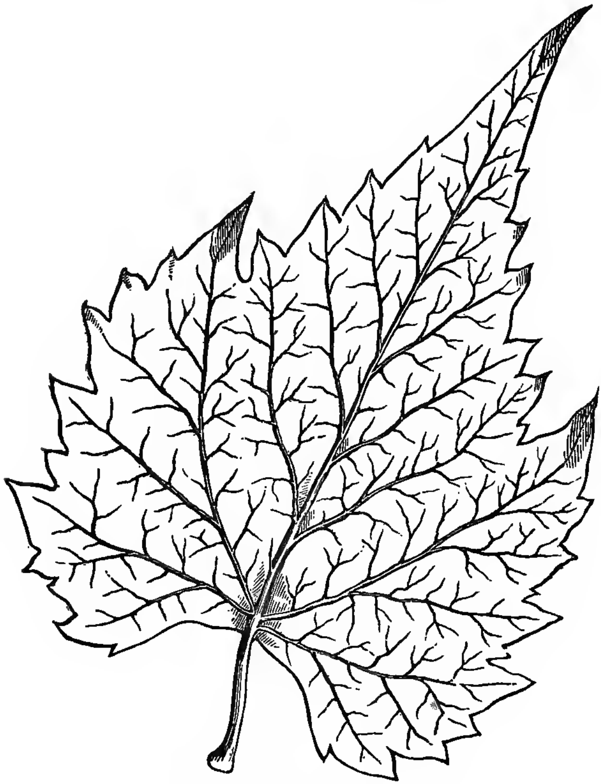

FIG. 31. THE NEBRASKA.

like those in the leaf of the Oporto, are called teeth, and such leaves are said to be dentated, or toothed; here the leaf is finely dentate, while in the Scuppernong (Fig. 32) they are coarsely dentate, and in the Yeddo (Fig. 33) crenate, or scolloped-toothed.

The leaf of the Nebraska grape (Fig. 31) is cut-toothed, the divisions being irregular and sharp. When the divisions are larger they are called lobes. In the Texas Post Oak grape leaf (Fig. 34), 1, 2, 3, 4, 5, are lobes, and the leaf is said to be five-lobed. The Yeddo leaf is three-lobed, and the Nebraska and Oporto are

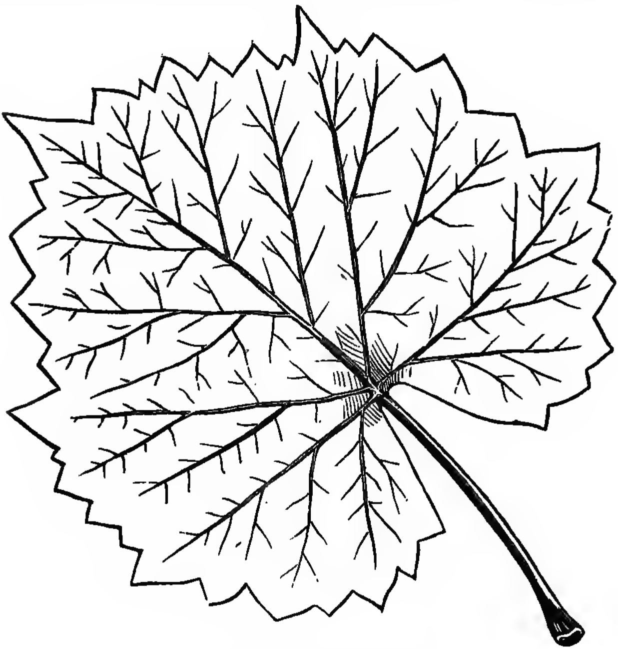

FIG. 32. THE SCUPPERNONG.

obscurely three-lobed. In the Post Oak grape leaf the lobes 1 and 5 overlap the leaf-stalk, and these portions which do this are called *alae*, or wings; some of the other lobes in this leaf overlap, but no distinctive name is applied to them. The spaces between the lobes, as well as the depression at the base of the leaf where the petiole is attached, are called *sinuses*, and the shape and depth of these afford distinguishing characters. These are the principal terms used in describing the shape of grape leaves, and the strikingly different forms can be described so that they may be recognized; but it is often the case that the difference in foliage in distinct varie-

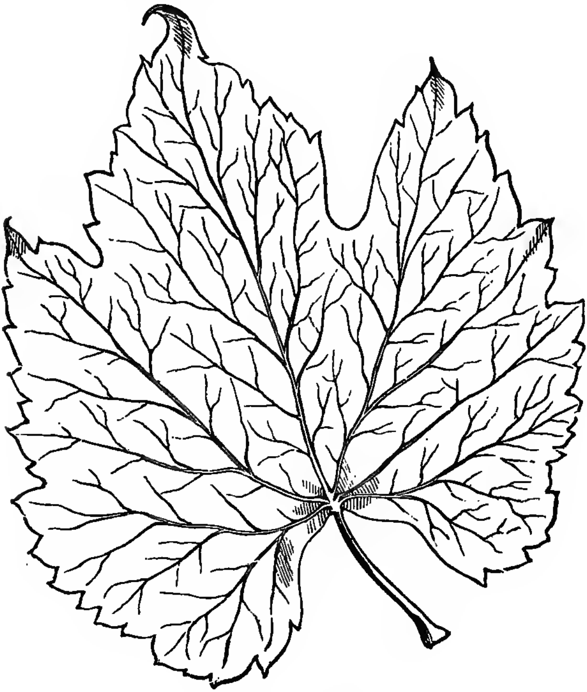

FIG. 33. THE YEDDO.

ties is so slight that, although it is readily perceived by a practiced eye, it is not possible to express these distinctions in words.

There are also many other marks that aid us in distinguishing the different varieties—perhaps the most variable of these is color, as the leaves of scarcely any two varieties possess the same shade of green, although it is the predominant color in all.

The Scuppernong leaf is a light green, and smooth on both sides, and shining on the upper; while the Post

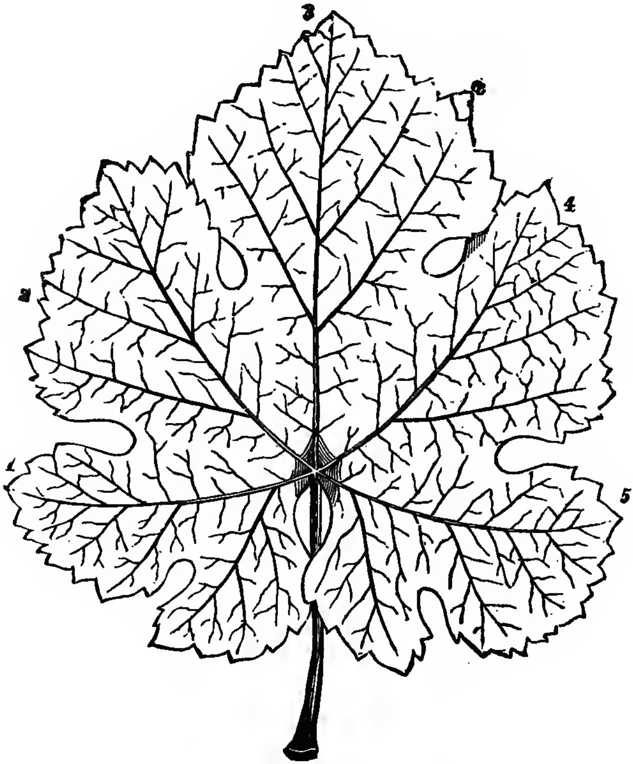

FIG. 34. THE POST OAK.

Oak grape leaf is a dark, dull green on the upper side, and rusty-woolly on the under side. The petiole and veins of some leaves are red, others dark brown, and in others the red color pervades, more or less, the whole leaf. When the leaves are smooth they are called *glabrous*, and if not, they are called *pubescent*—woolly, or hairy, according to the degree of roughness. When the leaves are merely smooth they are called glabrous, but if they have a polished surface, then they are called shining. When the leaves are covered with a whitish bloom,

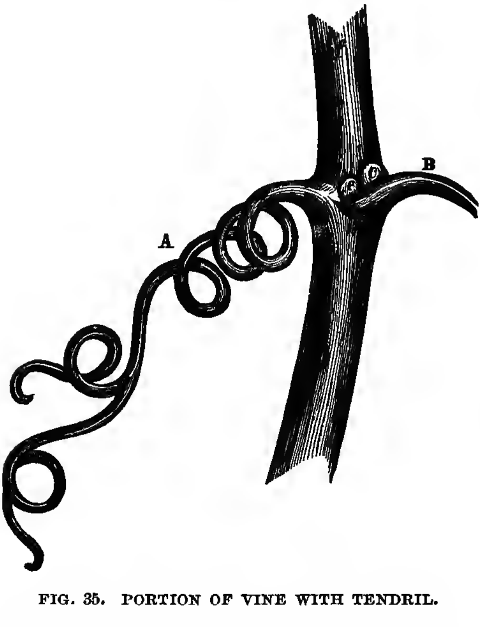

FIG. 35. PORTION OF VINE WITH TENDRIL.

or waxy substance that readily rubs off, they are called glaucous.

There is also a great difference in the texture of leaves; some are very thick and tough, while others are brittle. But the thinness or thickness of the leaf does not indicate the strength, for some that are quite thin are very strong and enduring.

Other characteristics of vine leaves might be mentioned, but enough have already been given to show that there is a sufficient number to enable a close observer to distinguish the different varieties, however closely they may be related.

Tendrils.—Tendrils are but a tortuous elongation of the woody fiber of the stem, and they preserve their vitality but one season.

They are always situated directly opposite to a leaf, and remain connected permanently to the stem until they decay; while the leaf is united only temporarily, and drops off at the end of the season. In the wild vine the tendril serves an important purpose, in assisting it to climb; in the cultivated vine, it being artificially supported, tendrils are no longer needed, and may be, in part, cut off while young, as they are not only useless, but will, if allowed to remain, often cause the vine to become entangled, and produce confusion where order is necessary. Fig. 35—*f* shows a portion of a vine with tendril (A) attached, the end of the tendril in two divisions, one considerably shorter than the other; both of these possess much interest when, instead of being tendrils, they are bunches of fruit.

The first three or four tendrils produced in spring upon bearing vines are but the peduncles, or flower-stalks, of the thyrse of flowers, which eventually becomes a bunch of grapes. But if the elements requisite to support the flowers and fruit are not supplied, or by accident the proper amount of light and heat is excluded, then these peduncles will become tendrils. Therefore a tendril may be said to be a barren peduncle, and a bunch of fruit a productive tendril, for they may become either under favorable circumstances. The divisions of the tendril referred to above show a peculiar characteristic in the formation of the bunch of fruit, which is seen in most of our native, as well as in many of the European varieties of grapes. The longer division becomes the main body of the bunch, and the shorter becomes what

FIG. 36. BUNCH WITH SHOULDER.

is termed the shoulder. Fig. 36 shows a bunch of grapes, as produced from a divided productive tendril. This form of bunch might be appropriately called the natural form, and certainly it seems to carry with it more of the general idea of a bunch of grapes than many of the other forms which are occasionally seen.

Sometimes a bunch is divided into several small clusters, which partly or entirely surround the main body; when this occurs they are called clustered bunches instead of shouldered. But as the bunches of fruit are more or less variable in the same kind of grape, it is not expected, in describing a variety, that more than their general character can be given.

Buds.—Buds are embryo plants, for they contain all the elements necessary to insure or secure, when removed from the parent, a distinctive, individual existence. They contain the rudiments of leaves and stem in a miniature form, and growth is but the development of these individual parts.

The principal buds of the vine are situated at the axils of the leaves only, and are never found upon any other part of the stem. They are naturally single—that is, produce but one shoot; but vines, when under cultivation, often show a disposition to produce a number of shoots from a bud; or, in other words, the buds divide indefinitely, and each division is capable of producing a distinct cane. Fig. 35—*e* and *c* show a double bud; such examples are often seen upon trained vines, and nearly every bud, upon vines that have been checked during growth, will show the double bud, both of which will often produce a shoot, but seldom of uniform strength. If a shoot that has started from a bud is broken off, others will immediately start from near its base. These are said to grow from accessory buds. They are sometimes incorrectly called adventitious; but adventitious buds do not exist upon the stem of the vine, as they do upon most other woody plants.

The word adventitious is from adventive, implying accidental, and not, necessarily, pre-existing in form; and as I am not aware of any instances where buds have been produced, by art or nature, upon the stem of the vine, except at the point where buds originally existed, we may conclude that they are accessory buds. Buds will sometimes be produced from the lateral roots of the vine at the point of separation, especially if they are of considerable size; these are, strictly speaking, adventitious. Although several shoots may be forced to grow from what is apparently a single bud, yet it is seldom judicious to do so, for if the bud produces but one shoot, it will be much more vigorous than if the strength of the plant is divided among several. It is a matter of considerable moment to the vineyardist that all the main buds be fully developed, and especially those that are required for producing fruit and bearing canes, as it is only from such buds that the largest and best fruit is produced. Keeping this fact in view, every precaution should be taken to preserve the vitality, as well as the full development, of the buds.

Nature has provided a protection to the buds, by covering them with bud-scales, which ordinarily serve to protect them against the sudden changes of the atmosphere while they are dormant; but in some sections of the country this protection is insufficient, and their vitality is either entirely destroyed, or very much injured. In such localities an artificial protection must be furnished. The method of applying such a protection will be given in another chapter.

CHAPTER XIII.

PLANTING THE VINE.

There seems to be as great a diversity of opinion among vineyardists in regard to the best time to plant, as there is upon the various details connected with planting. My own rule is to plant vines in the fall, whenever circumstances will permit me to do so; but if it is not convenient to plant at that time, then I do the next best thing—that is, plant them so soon in the spring as the soil is in a condition to permit of it. I prefer planting in the fall, because the soil becomes settled about their roots, and all wounds made upon them in the process of transplanting will, in a great measure, become healed, and very often new roots will issue before the ground would permit of the vines being planted in the spring. Thus they become all ready to commence growing as soon as the frost is out of the ground.

The buds will commence swelling at the first approach of warm weather, and they are then very brittle and liable to be broken off.

I think, as a general thing, vines planted in the fall will make at least one-third more growth the first season than when planted in spring. In very cold localities, or in soils that are naturally tenacious and heavy, spring planting is, perhaps, preferable to fall. But it should be a maxim with the vineyardist, "never put off until another season that which may be safely done in the present."

The condition of the soil must, in part, govern us in this operation, for it will not do to plant the vines when the soil is soaked with water; for in that condition it can not be readily divided so as to be made to intermingle with the roots. Nor will it do to plant when the soil is parched and dry; but it should be in that moist and friable condition which allows it to be easily worked.

Root Pruning.—However carefully vines are taken up from the nursery, the ends of a greater portion of the roots will be broken off. These should be cut smoothly before planting. It is also beneficial to shorten the roots considerably, especially if they are long and destitute of branching fibers. Two feet is long enough to leave any root upon a two or three-year-old vine; longer ones should be cut off, not only to render them more convenient for planting, but to incite the main roots to throw out new ones from their ends, as well as from their sides. The soil will thereby become filled with feeding roots, instead of a few long naked ones, that have no power of absorbing food except through the small fibers which exist only at their extreme ends. The soil within the radius occupied by these long roots is useless, so far as furnishing nutriment is concerned, because they are not capable of absorbing it. It will often be necessary to shorten the roots to less than two feet, and it is best to cut off a portion of the ends, no matter what their length may be. For it is not the length or number of roots that determines the quality of the vine, but their condition. If long, soft, spongy and unripened wood and roots are left upon the vine, they are of but little benefit to it, at best, and they will often die, and in their decay communicate disease to the other and more healthy portions of the plant. This is particularly the case with layers—their roots being produced late in the season, they are seldom ripened to their full length; hence the necessity for severely shortening their roots. And here, I believe, is the chief cause of so much discussion upon the value of layered plants. Those who obtain properly grown layers and cut back the roots to at least one-half their length before planting, pronounce them to be equal to plants grown in any other way. But those who have pursued the opposite, and planted them with their roots entire, often fail to produce healthy or vigorous plants, and therefore condemn them.

Vines will sometimes have so great a number of roots that when transplanted the number of buds left upon the stem is insufficient to call them into action, and they perish, in consequence; for roots will not remain entirely inactive for any considerable time during the growing season without suffering. If the roots are so crowded that they can not be distinctly separated and a clear space be allowed for each when placed in the ground, then a portion should be entirely removed.

If the texture of the soil is such as to make it congenial to the growth of the roots, and permit them to permeate it without hindrance, their course will be more inclined to the horizontal than the perpendicular, and certainly the former position is more desirable than the latter. For when the roots spread out horizontally, they remain near enough to the surface to receive the full benefit of all top-dressings of manure which may be applied to the vineyard. They are also more accessible to heat, air and moisture, than when they penetrate deeply. And while it is desirable to encourage the spreading of the roots in every direction, so as to occupy every portion of the soil, and have them near enough to the surface to receive all the benefit possible from such a position, yet we should not place them too near the surface at the time of planting, nor endeavor to keep them there. For unless the roots are covered deep enough to prevent their being affected by sudden atmospheric changes, the vine will surely suffer. Roots that are near the surface appear to be more sensitive than those which are deeper, and they are the first to start in the spring, and the first to be checked by cold in the autumn, or by long drouths in summer. The depth to which roots should be covered depends somewhat upon circumstances. In light soils they should be covered deeper than upon heavy, because the air has a more ready access to a porous soil than it has in one that is tenacious; and while it is necessary that air should reach the roots, it is not judicious to allow it to penetrate too freely, because roots require a partially confined atmosphere, and not one that has any apparent circulation. There is one class of cultivators who advocate deep planting, and they place the roots from twelve to twenty-four inches deep; another class follow the other extreme, and but little more than cover the roots with earth, and then depend upon mulching for the requisite protection; and although both of these extremists offer many plausible arguments in support of their different theories, yet a middle course, I am confident, is the safest and best.

How to Plant.—When a number of vines are to be planted, it is best to dig the holes before the vines are taken into the field, and when they are taken from the place where they have been heeled-in, their roots should be kept in a box or basket filled with damp moss, or protected in some such manner from the air and sun. The vines should also be pruned before they are taken into the field. Prune the roots, as has already been directed, and cut off the stem to about eighteen inches. The holes to receive the vines should be dug in a circular form, and from six to ten inches deep upon the outside, and four to six inches in the center; then set a good strong stake in the center of the hole; for unless the stake is placed in position before the vine is planted, there is great danger of injuring some of the roots of the vine in driving it down by its side after it is in position.

Now set the vine in the center of the hole close by the stake, spread out the roots in every direction, and throw on a little soil as you proceed, to hold them in position. When all the roots are properly distributed, then fill up the holes, pressing down the soil with the foot—the weight of a man will not be too much pressure to give the soil over the roots. It requires two men to work to advantage in planting, one to place the vine in position and spread out the root, and another to put in the earth. Fig. 37 shows the form of the hole, with the stake and vine in position, ready to be filled up. The roots should

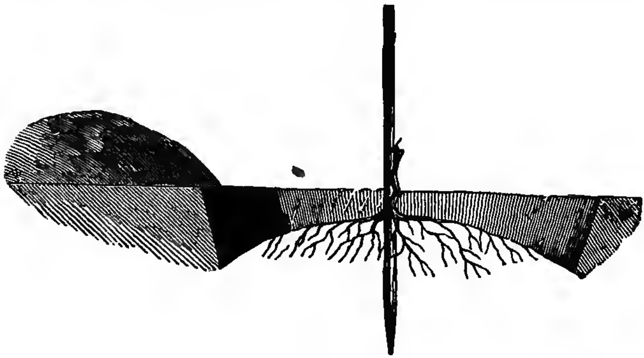

FIG. 37.

always descend a little from the stem to their farthest point, and in pressing down the soil upon them, it should be given the same pressure, as near as may be, along their whole length. If the vines are planted in the fall, then a small mound of earth should be made around the stem, so as to protect two or three buds above those that would be covered if the ground were made level. But when the vines are planted in the spring, the hole need not be filled quite full, but a shallow basin may be left about the stem so that the rains shall more readily reach the roots. This basin around the vine may be filled when the vine gets well started into growth. When the buds begin to push into growth, select the strongest and rub the others off; a bud near the ground is preferable to one that is a foot above, and this is one reason why the vines should be cut off quite short when planted, as it makes the lower buds more sure to push. After the one bud or shoot has been selected, the old stem above it may be cut off to within two inches of the young shoot. As the young cane grows, keep it tied to the stake, but do not tie it so tightly as to interfere with its expansion as it grows. Keep the laterals stopped, according to the directions already given. Stir the soil about the plants, the oftener the better, and keep down all weeds.

Bass is an excellent material for tying the vines, as it is not liable to injure the tender shoots; besides, it usually costs less than common twine.

When any particular vine, or a number of them, do not grow as rapidly as desired, they should receive some extra stimulant, either liquid manure from the barnyard, or a solution of some of the concentrated manures in water, giving enough to completely saturate the soil to their roots. When it is not convenient to apply stimulants in a liquid form, a barrow load of compost may be spread upon the surface about the vine. We should endeavor to produce a uniform growth, so that all the vines in each row, at least, shall be as nearly of the same size as possible.

The vines, at the end of the first season, will usually be large enough to be pruned for training, but many of the more feeble growing varieties will require another year, and they should be cut back in the fall or winter to two or three buds, only one of which should be allowed to grow, as in the first year.

CHAPTER XIV.

GRAPE TRELLISES.

The usual manner of making grape trellises is with wire running horizontally, and this answers very well with all the various systems of training, except in the arm and upright bearing canes and spur pruning, which is described in the succeeding chapter. For the arm and spur pruning I much prefer a trellis built as shown in Fig. 38, consisting of two horizontal bars and perpendicular wire. Everybody who has made trellises in the ordinary manner is aware of the difficulty of keeping the wires straight, even if the posts to which they are fastened are not more than eight feet apart, as the wires will contract and expand at every change of temperature, being loose on hot days and tight on cold ones. Besides, much larger wires must be used, if put on horizontally, to support the fruit and the vine. But the most serious objection that I have found is, that the wires, unless very near together, are not where they are most needed when the young upright bearing shoots first start, for they must be tied to something to support them when only a few inches long, or they are very liable to be broken off by heavy, driving rains. If the wires are eight inches apart (which is nearer than the usual custom to place them), the young shoot must be at least twelve to fifteen inches long before the strength of the vine will admit of its being tied to the horizontal wire; besides, when tied, the strings will allow the shoot to slip lengthwise of the wire, and often it will crowd, or become entangled with its neighbors. To tie the vine very tight to the wire would cause it to become girdled as it expanded in growth.

These are but a few of the difficulties which I have had to overcome in using the common grape trellis with horizontal wires or bars, and to avoid these difficulties I have adopted a trellis with horizontal bars and perpendicular wires, shown in the following illustration. It is built in the following manner: Select posts of good, hard, durable wood, of from four to six inches in diameter, and six and a half feet long; set them in the ground two and a half feet deep, and in a line with the

FIG. 38.

vines, and eight feet apart—that is, if the vines are that distance apart; a post should be placed between each two vines at equal distance from each. When the posts are set, nail on strips two and a half to three inches wide, and one inch thick, one strip, or bar, being placed one foot from the ground, and the other at the top of the posts. Then take No. 16 galvanized iron wire and put it on perpendicularly, twisting it around the lower and upper bar, each wire being placed just where the upright bearing shoots are to grow. It is well not to put on the wires until the vines are ready for training, and then lay down the arms by the side of the lower bar, and make a mark on it where each wire is to be put, before fastening the arm; then remove the arms to one side while putting on the wire. If a wire should not be in the exact place where it is wanted, it can be easily moved to the right or left, provided it is only twisted around the bars. The distance between these upright wires will differ according to the variety of vine, as the distance between the buds varies very materially in different varieties, but usually from eight to twelve inches will be the proper distance, sometimes wiring at every bud, and with others only at every alternate one.

It will readily be seen that in this mode of making a trellis, when the young shoots start they can be tied at any time when necessary; and there is no need, nor is it judicious, to tie them tight to the wire; they should be left at least one inch from it, the two shoots being tied to the one wire. The cost of wire is less than when large horizontal wires are used. The arms should be fastened to the lower bar, either by strips of leather tacked on or by tarred twine tied around the arm and lower bar. It is impossible for me to give anything like a correct estimate of the cost of building a grape trellis after this plan, because the different materials used in its construction are very variable in price; besides, that which would constitute the greater part of the expense in one section of the country, might be the least of it in another. Galvanized iron wire should always be used in preference to any other. It costs from three to five cents per pound more than the common annealed wire, but its lasting qualities are so much greater that it fully compensates for the additional expense.

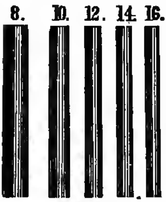

FIG. 39.

This form of trellis may also be used for other modes of training, such as the fan system, bow system, etc., provided the vines are to be trained low on the trellis.

Fig. 39 shows the relative sizes of such as are commonly used for trellises. Nos. 14 and 16 are large enough for the perpendicular wires on such trellises as I have described; 8 and 10 are the sizes used when put on horizontally. The number of pounds of wire required for a given length of trellis may be readily ascertained by calculating the number of feet required, and then dividing the amount by the number of feet in a pound, which is as follows:

No. 8. 13 feet to the pound.	No. 14. 54 feet to the pound.
No. 10. 20 " " "	No. 16. 102 " " "
No. 12. 33 " " "	

CHAPTER XV.

TIME TO PRUNE VINES.

The time for pruning vines will vary with the locality in which they are grown; but, as a general rule, it may be commenced as soon as the vine has shed its leaves in the autumn; and if the wood is to be used for propagation, it is certainly better if taken from the vines before it has been severely frozen. But in pruning in the autumn or winter, the vines should not be cut back to the bud or buds that are wanted for fruit, but leave one or two extra ones above them, and then go over the vines a few weeks before they start in the spring, and cut off these extra buds. This second pruning I usually do the last of February or the first of March, always pruning before the cold weather is entirely past; for if delayed until the sap begins to flow rapidly, it will issue from the wounds in such excessive quantities as to materially injure the vine. If the vines are pruned in the autumn down to the buds which are wanted for producing fruiting canes, the uppermost buds are very likely to be winter killed. Even where the winters are not severe it is best to leave one extra bud, because the sap will usually recede from the part which has been cut, and the end will become somewhat dried, if not injured by cold.

Where vines are laid down and protected in winter, then the pruning may be completed at once, as no second pruning will be necessary, the covering given to the vines protecting them both from the effects of the cold and dryness. Some vineyardists do not prune at all until the latter part of winter or early spring, in which case no extra buds should be left. There is a theory in regard to time of pruning which is of very ancient date, and as it has been, and is still, taken as a partial guide by many cultivators, in pruning, not only the vine, but other fruit-bearing plants, I will give the main points of it as briefly as possible. According to this theory, when cold weather first checks the growth of the vine it does not entirely stop the absorption of food by the roots; consequently the vine becomes surcharged with sap, the liquid portions of which are partially given off by evaporation through the bark and buds, and the more solid portions are deposited throughout the entire length of the vine, so that each bud is equally supplied with its quota of food with which to commence vegetation anew in the spring. Now suppose a portion of the vine is cut away early in the fall, it is evident that that which remains has the whole root for its support, and it may receive all the strength that would have been diffused throughout the unpruned vine. The few remaining buds will, of course, put forth in spring much more vigorously, and send out fruit-bearing wood in greater perfection than it is possible for an unpruned vine to do.

I doubt the truth of this theory; but, according to it, the rule for pruning would be: If the vine is weak, prune early—that is, so soon as it sheds its leaves; but if it is a vigorous grower and a shy bearer, then prune late. That pruning the vine at different periods produces a different result is no doubt true, but it is difficult to determine just how much difference it makes, because no two vines in the vineyard will grow two successive seasons with exactly the same vigor, even if they are pruned at the same time both years.

Pruning and Training.—Having endeavored, in the preceding pages, to give the necessary details for laying the foundation of successful grape culture, we will now consider the best method of building up and completing the structure. No matter how thoroughly this foundation has been laid, or how congenial are all the surroundings, unless we practice a system of pruning and training that harmonizes with the known laws that govern the growth of the vine, all the care that has been or may be bestowed upon it will not bring bountiful crops, or insure us against a partial, if not a total failure. The success of grape culture in this country depends almost entirely upon a general diffusion of practical information relative to pruning and training.

There is certainly much depending upon the adaptation of varieties to different localities, as well as the mode of culture adopted; but these points seem to be better understood than pruning and training, as information relative thereto is easily conveyed through the ordinary mediums for reaching the public. The interest manifested at the present time in grape culture owes its origin, in a great measure, to the fact that with the introduction of new native varieties of superior merit, the attempt to cultivate foreign varieties in the open air has been discontinued, thereby removing one great cause of failure. Many persons who experienced failure from this cause pronounce all attempts at grape culture in this country to be useless. Another class of cultivators, having escaped the foreign grape fever, have caught the native one, and, judging from observation only, condemn not only the foreign varieties, but all the modes and systems ever adopted for their cultivation; some of these cultivators are now groping their way in the dark, following no system, because they have been unable to find one in which there is nothing foreign. I have digressed from the more practical part of my subject, to show how readily some will let their prejudices lead them from one fatal extreme to another.

While I rejoice that the time has come when no intelligent man in the Northern States would think of planting a vineyard with foreign varieties, still I am not ready to admit that all the experience of the vineyardists of Europe is of no practical value to us.

The same laws that govern the growth of the foreign vine control that of ours, and I have no reason to doubt that some of the best systems of training that have been so long successfully employed in Europe would, with slight modification, be almost as successful here. I know that it has been repeatedly asserted that the American species and varieties of the grape are much stronger and of coarser growth than the foreign ones, consequently they cannot be so readily brought under control, or be kept within similar limits, without destroying their usefulness. But my own experience and observation lead me to think that, so far as regards growth, this is an error, and that, naturally, the foreign are, on the whole, as vigorous growers as are our native varieties. When grown under glass they appear to be more so, and whenever they are grown in a favorable situation in the open air they are not only strong, but often rampant growers. We can not arrive at a correct estimate of what their natural growth would be, under favorable circumstances, by what we see in the old vineyards of Europe, where the soil has been under cultivation for centuries, or by observing them in our own country, where they seldom pass the first season without being attacked by disease.

It is not necessary for us to follow strictly any of the European systems of culture or training, but by gathering from foreign experience that which is of value to us, and sifting out principles from prejudices, we may arrive at facts which are very important.

It is not necessary, nor would it be judicious, for us to undertake to dwarf the native vine to that extreme to which it is carried in some parts of Europe, but we may stop midway between it and the wild vines of our forests. I know there are some who are continually pointing to the wild vine as an example of what the cultivated vine should be, and they tell us that these vines bear fruit and are free from disease. This we are ever ready to admit; but we are not cultivating the wild vine, but improved varieties, many of which have parted with much of their wild character; and even if they had not, would these sticklers against progression be willing to plant vines, with a small seedling parent tree by the side of each for its support, and then wait from ten to thirty years for the vine and tree to grow up together, at the end of that time getting no more in quantity, with less in quality, than they now compel a cultivated vine of three or four years to give them? If they are willing to follow nature in every particular, I have not the least doubt that any of the improved varieties will be found to grow and remain healthy without pruning or training. For my own part, I take nature as a guide; the only difference being that I interpret her differently from that class of vineyardists who follow no system, and thereby are ever ready to thwart nature, but never assisting her.

There are certain general principles that govern the growth, as well as the fruit-producing powers, of the vine; and while all the operations in the vineyard should be subservient to them, the details in carrying out the necessary forms may usually be varied without materially affecting the final results.

The vine is one of the most tractable of all known fruit-bearing plants, and the easiest to control, although possessing apparently such a wild and rambling nature.

Its natural growth is upright, its tendrils furnishing ample means to assist it in climbing; and while it remains in an upright position, the larger portion of the forces of the plant are expended in producing a growth of wood and leaves, while fruit is produced but sparingly.

This fact we see illustrated in the wild vine; for it is not until it reaches a position where it can spread out horizontally, that we find it producing abundant crops.

We see the vine in the forest, spreading over and enveloping like a mantle the towering oak, or covering the low alder by the water side, its clusters of fruit hanging in the shade beneath; and from it we learn several fundamental principles. 1st. That while the leaves require a full exposure to the sun, the fruit ripens fully without it. 2d. That while the vine grows upright it produces its most vigorous growth of wood, but its fruit-producing powers are not fully developed until it takes a horizontal position. 3d. That fruit is produced most abundantly upon the uppermost branches, and that it makes no difference whether these upper branches arc on the tops of lofty trees or on the humble shrub. This proves conclusively that it is not, as some cultivators contend, the height that is necessary for the vine to bear well; for the fruit that is fifty feet from the earth is no better than when it is at five, other circumstances being equal. It only shows that the sap naturally presses to the top and forces out fruit-bearing branches at that point. I do not mean that the upper buds upon a one-year-old cane will produce fruit, for this they will seldom do, as they are not generally fruit buds; but if the cane is cut back to a well-developed bud, and remains perpendicular, or nearly so, then the upper bud is far more certain to produce fruit than those below it. Or if the young canes are bent (either by art or by their own weight, as we see them in their wild state) so as to check the flow of sap, and place the fully developed buds in a higher position than those at the end, then they will push out and produce bearing canes. Therefore, the vine is said to bear its fruit at the top, as a rule, but it does not strictly refer to the uppermost buds. 4th. The fruit is produced upon the young growing canes, and opposite to the first few leaves that are formed; usually the first to third leaves formed will have a bunch of fruit opposite; sometimes they will extend to five bunches. When the shoot has produced its fifth leaf without showing signs of fruit, then none need be expected, for it is very seldom that fruit is produced beyond that point. And as this rule is applicable to all the varieties and species in cultivation, it renders it an easy matter to regulate the quantity of fruit upon the vine at the annual pruning, by simply leaving a certain number of well-developed buds, estimating each one at so many bunches of fruit. Not only is the fruit produced near the base of the young canes, but the best buds for producing fruiting canes are found there also; for as these lower buds are formed early in the season, they become more fully developed than those formed later. Hence the necessity for cutting off the upper portions of every cane in pruning, instead of leaving a part of them at full length, and cutting others entirely away.

This, however, applies only to canes that are checked in summer by pinching off the extreme ends, for when a cane is allowed to grow six to ten feet, or a greater length, the lower buds are very likely to be overgrown, or smothered, and it becomes necessary to select buds for fruiting higher up on them; or, in other words, we must prune them longer than those which have been summer pruned.

The foregoing are the main principles to be observed in pruning and training; but there are minor points also to be considered, because they are not only important, but are facts that have been proven to be well founded by long and careful experiments. These points will be noticed when I reach that part of the subject where they are particularly applicable.

The following system of pruning and training was selected when writing the first edition of this work, because it was old, well established and perfectly practicable, and it seems to harmonize with the general development of the vine, and does not unnecessarily dwarf it, but keeps it perfectly under the control of the vineyardist, so that he can develop the fruit-bearing powers and check the excess in the growth of wood, and so distribute the fruit that no one part of the vine produces more than another. It is not a new system, but its main features, which are the horizontal arms, and pruning the young wood to short spurs, have been in uninterrupted use in French vineyards for at least one hundred and fifty years.

It is true that some of my critics have called it a "fancy system," and even accused me of drawing wholly upon imagination for illustrations, although the larger part of these were made from living vines then growing in my grounds on Long Island. Grape culture has changed somewhat during the past thirty years, and it is quite probable that the vineyardist of to-day cannot afford to give as much time and labor to the training of his vines, with grapes at from three to six cents per pound, as when they would readily sell at three or four times this price. But the value of the product does not affect the principles of vine growth, and when the novice, or even experienced vineyardist, understands these well enough to train vines on the "arm and spur system," as shown and described in this chapter, he will have no difficulty in adopting and employing those given in succeeding ones. It is certainly the most artistic and scientific of all the systems heretofore introduced or invented, and it demonstrates the susceptibility of the vine to respond to the influence and guidance of the mechanical skill of the vineyardist. The following method of low training is especially recommended for vineyards, particularly where strong winds prevail and render it difficult to grow vines on high trellises. Plant the vines in rows, six feet apart, and the vines eight feet apart in the row, and let but one cane grow the first season; keep it tied to the stake, and pinch back the laterals, to concentrate the growth into the one cane. The rows may run east and west, or north and south; perhaps east and west would be preferable in more northern localities, but the difference in this latitude is scarcely perceptible. If the rows run east and west, the leaves will be mostly on the southern side; but when north and south, they are about equally disposed on both sides of the trellis. Fig. 40 shows the vine as it should appear at midsum-

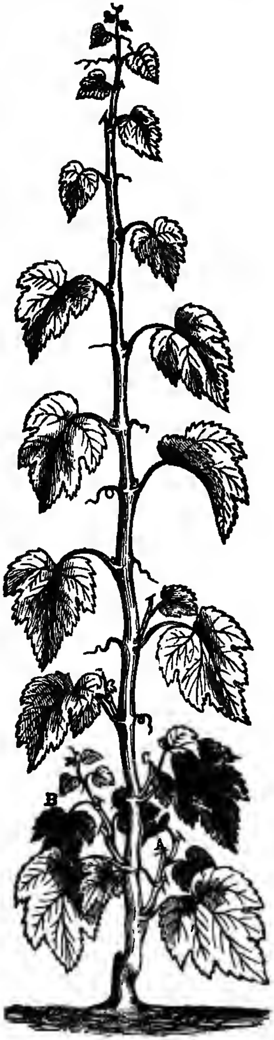

FIG. 40.

mer; A is a lateral that has been stopped three times; B has been stopped twice; C but once. This cane is to be cut back the next season to within twelve to fifteen inches of the ground, and only the upper two buds are allowed to grow, all others being rubbed off. From these upper two buds two canes are produced, as shown in Fig. 41, each one of which should have the same treatment as did the single one of the previous season. The second season the vine will usually produce three bunches of fruit on each cane; and if it is strong and vigorous, these may be allowed to mature; but if the vine is not strong, they should be removed on their first appearance. The canes, at this age, should be from eight to twelve feet long, and at least half an inch in diameter. If much smaller than this, one of them should be cut away, and the other cut back to two buds, and two canes should be grown, as in the previous season. When strong vines are planted, and good culture is given them, they will be ready for training at the end of the second season. The trellis should now be built, if it has not been made before. (For description of trellis, and how it is built, see Chapter XIV.) The two canes of the vines are now shortened to four feet, bent down in opposite directions, and laid against the lower bar of the trellis to form arms. Select five or six of the buds on the upper side of the arms thus laid down, to be grown into upright canes, making a mark on the trellis bar opposite to each. If the vines have grown strong, the buds

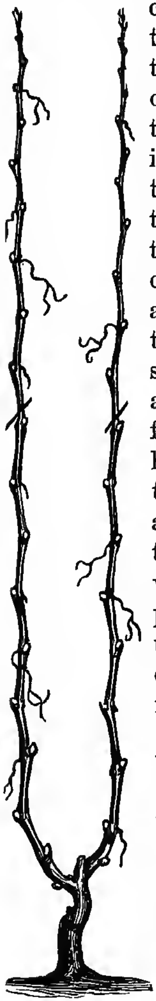

FIG. 41.

will be from six to eight inches apart, in which case every bud on the upper side may be allowed to remain. From the marks opposite the buds stretch No. 16 galvanized wire to the bar above, fastening each end securely by winding about the bar or otherwise. Instead of now fastening the vine to the trellis, it is better, but not absolutely necessary, to bring the ends down near the ground, and fasten them there with hooked pegs, as seen in Fig. 42. If the ends are fastened to the lower bar in a horizontal position at once, the buds nearest to the base will usually push first, because the short bend in the cane at that point checks the flow of sap and forces it into the buds near by, while the sap that flows past these buds goes rapidly to the extreme end of the arm,

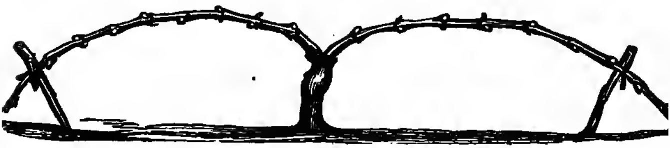

FIG. 42.

and forces the buds at that point into growth. In such cases the buds between those at the base and the extreme end will sometimes fail to produce canes. To avoid this we bend the canes as represented; this graduates the check which is necessarily given to the flow of sap, and each bud stands more nearly the same chance to get its proportion. When the buds have all started, and made a growth of two or three inches, then the arms should be brought up level and fastened to the side of the lower bar. All buds and shoots not wanted for upright canes should be broken off, and so soon as those remaining are long enough to tie to the upright wires, it should be done. They should not be tied too close, as room enough should be left for them to grow. It will sometimes happen, when the arms are laid down, that in selecting buds for the upright canes, the spaces between would be made more nearly equal if an occasional bud on the under side was used for the purpose; if so, it may be done, and it will do equally well, only it will not appear quite so systematical. Fig. 43 shows a spur produced upon a shoot grown from an under-side bud.

Each one of these upright canes will, if permitted, usually produce three or four bunches of fruit, and if the vine is very strong and vigorous, it will not injure it to do so. But unless it is very strong, it is better to cut off a portion and leave only one or two bunches to each cane. It is better not to overload the vine while young, as it will often seriously injure its future growth. When the upright canes have grown to about two feet, they should be stopped by pinching off their ends. I usually pinch off the end of the shoot so soon as it has made two leaves beyond the last bunch of fruit, which will be when the cane has from five to eight leaves upon it. But we cannot expect to be exact, especially when there is a large number of vines to go over. Besides, one cane may grow more rapidly than another, and will need pinching sooner. Pinching will cause the remaining leaves to expand and become large, thick and firm, and much better fitted to

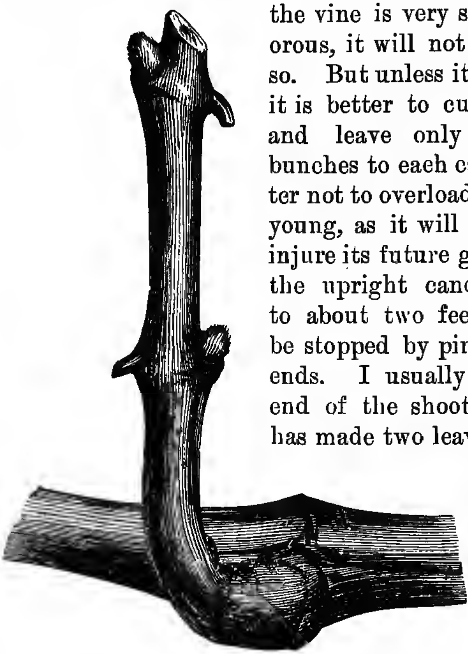

FIG. 43.

withstand the atmospheric changes than they would otherwise be. The shoots, after being stopped, will soon start, and after growing a few inches they should be checked again, as we wish to *keep* them within the limits of the trellis, and not allow them to grow much, if any, above it. All the laterals on the canes should be stopped, as though they were on young vines. Fig. 44 represents a vine at the end of the first season, after the arms are formed. The first upright cane at the left hand of the center shows the position of the three bunches of fruit. Upon this vine there are twelve upright canes, six upon

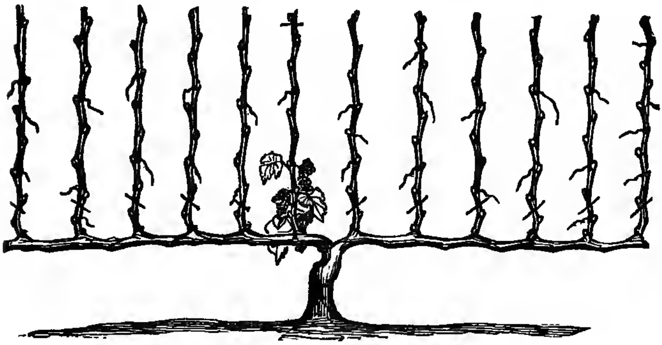

FIG. 44.

each side, which are distributed on two arms of about four feet each; it is not expected that the arms will be of an exact length, but they need not usually vary more than three or four inches. Nor do we expect to have the upright canes exactly the same distance apart; but if care is taken in the beginning in selecting the buds, there will be no material difference. No more fruiting canes should be allowed to grow on one arm than upon the other, nor should any number of the canes be allowed to grow higher than the others, and thereby appropriate more than their due share of nutriment. Keep the vine

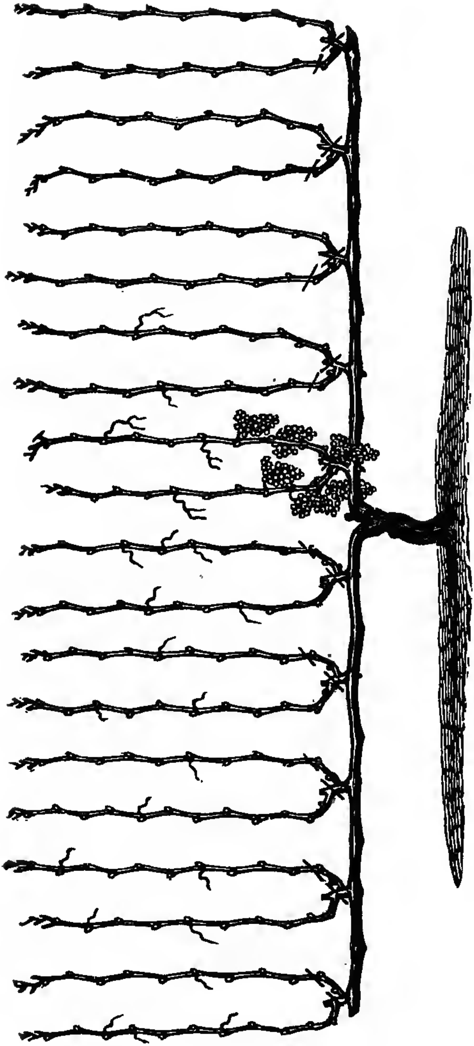

FIG. 45.

equally balanced in fruit, foliage and wood. The vine referred to above has six upright canes, which, if evenly distributed, would give eight inches space between each, which is abundant for those varieties that have leaves of moderate size. But with those that have very coarse wood and large leaves, the distance between the upright canes should be ten or twelve inches.

The upright canes are pruned back the first year to two buds; the small cross lines near the base of the canes, Fig. 44, show where they should be cut. The next year a cane will proceed from each of these buds, and all other shoots which may start from the small buds near the arm should be rubbed off. Or, if the buds should produce two shoots each, as they will sometimes do, only the strongest one should be allowed to grow.

The second year the two canes will each produce three or four bunches of fruit, and instead of twelve upright canes we now have twenty-four, and allowing three bunches of fruit to each, it gives seventy-two bunches to each vine, and this is not an over-estimate for the product of a vine the fourth year after planting. The canes are to be treated the same, as regards stopping, pinching, laterals, etc., during each year of their growth.

Fig. 45 shows a vine at the end of the fourth year, but with only five spurs, with two canes on each, making ten bearing canes on each arm. The first two canes at the right hand of the center are represented with the three bunches of fruit upon each. The cross lines near the base of the shoots show where the vine is to be pruned at the end of the fourth year. The uppermost of the two canes is cut entirely away, and the other is cut back to two buds.

Fig. 46 shows this same vine as it appears after being pruned. The vine, in subsequent years, is to be pruned in the same manner. Fig. 47 shows a portion of the arm, with the base of the upright shoot, or spur, as it is called. The cross line shows where the upper cane is to be cut away. Each year the pruning should be reversed, if the position of the lower bud will admit of it. That is, if we cut away the left-hand cane this season, as shown in the last figure, then we should cut away the right-hand cane the next; in this way the spur will remain nearly upright. But sometimes the lower bud will be on the outside of the shoot which we wish to keep for the fruit spur. Fig. 48 shows a spur with the buds in that position; but we must prune the spur just the same as though it were on the opposite side, and probably the next season the buds on the young shoot will be reversed, and we shall be able to bring our fruit spur again into a perpendicular position. The lower bud will seldom be produced two years in succession on the outside, as shown in Fig. 48. It is desirable that the shoot from the lower bud on the fruit spur should grow strong, as it is from this that we take the two buds for the next season's fruit spur. As this first, or lower bud, is seldom more than one inch from the base of the shoot, and in many of our best short-jointed varieties not more than a half-inch, it is obvious that we lengthen the spur

FIG. 46.

each year only the distance from the base of the shoot to the first bud on it, be it more or less. The annual increase in diameter of the arm, as well as that of the spur, also lessens somewhat its projection above the arm. Taking the average of some twenty varieties that I have trained on this plan, I find the spurs do not increase in length more than three-fourths of an inch each year. At the end of the fourth year the vine is considered as established, and as another vine is at the same distance from it with arms extending each way, of course the space is all occupied, and the vines are to be confined within the limits of eight feet each. The rows being

FIG. 47.

FIG. 48.

six feet apart, we have nine hundred and five vines on an acre; now seventy-two bunches to the vine (which every vine will bear if it is a productive variety, and if it is not it had better be discarded at once, unless it possesses some extraordinary quality which makes up for loss in quantity) will give us 65,160 bunches to the acre; the weight, of course, will vary according to the size of the bunch. But it is not best to let the vines bear too much while young, as the quality of the fruit will not be as good as though a less quantity were taken; besides, it is very likely to severely check the growth of the vine.

Varieties that are not strong and rapid growers may be planted nearer together, say six feet apart in the row, and the rows only five feet apart, and it is not necessary that the trellis should be so high by half a foot, at least; two feet and a half between the bars will be sufficient for many of the shorter jointed varieties. Sometimes the vines are planted more than eight feet apart, and only a part of the arm is formed the first year, and the upright cane nearest the end is laid down the second year, and the arm thus lengthened in this

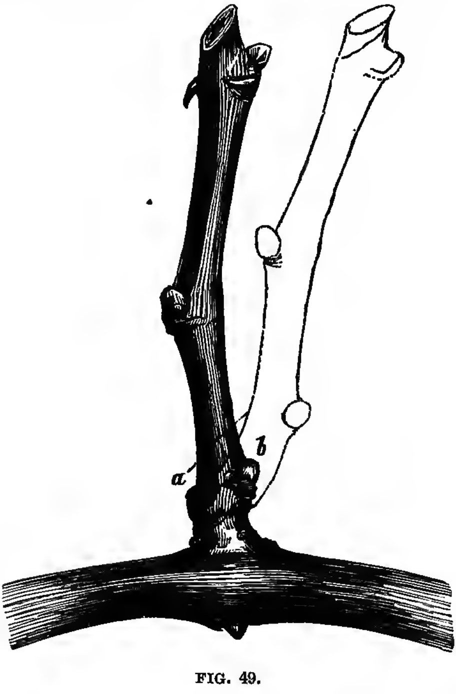

FIG. 49.

way until the required length is obtained. But having tried both, I much prefer planting the vines so near together that arms can be formed to fill up the space at once. Four feet is about as long as it is safe to lay down a cane at one time, and have all the buds start evenly.

When the vine becomes old and very strong, the amount of fruit may be increased by pruning, so as to leave three buds upon the spurs, as is shown in Fig. 49; this will increase the crop one-third. But there is danger of losing the lower bud if we increase the number beyond this, as we find that the tendency of the sap is continually to the upper bud; and when there are several left on the spur, the lower one is apt to be robbed by those above it, and more likely to remain dormant than when we prune back to two or three.

If the lower bud fails to grow, then we have to depend upon the first growing one above it for the fruiting cane for next year; this will add very materially to the length of the main spur, besides injuring the general appearance of the vine. In the above figure the dotted lines (*b*) show the position of the young cane that should grow from the lower bud, and a similar cane will be produced from each of the other buds.

The cross line at *a* shows where the old spur, with the two upper shoots, which are now only buds in the engraving, will be cut away at the next year's pruning, and the three buds now on the cane, *b*, will be left. Too mnch care cannot be given to the preservation of these spurs on the arms, for if one is broken off or destroyed by injudicious pruning, there is no certainty of replacing it, although buds will sometimes start from the arm near its base, and from this a new spur may be formed; bnt it is better to preserve the original spurs than to endeavor to replace them with new ones.

Should the spurs ever become so long as to be unsightly or inconvenient, new arms may be readily formed by allowing the two center spurs to produce but one cane each, and these may grow four or five feet long; at the next pruning cut away the old arms, and bend down these two canes to form new ones. But if the plan which I have given is strictly followed, the arms need not be renewed oftener than once in fifteen or twenty years.

There are several reasons why I believe the foregoing method is one of the best systems for training vines. 1st. The horizontal is the best position that can be given to the vine to develop its fruiting powers,—the main object in all the various methods of pruning and training. 2d. The upright bearing canes being equally distributed on the arms, no one portion of the vine has any advantage given it over another, the flow of sap being equal to all parts. 3d. The equal distribution of the fruiting canes not only allows a free circulation of air among the leaves, but insures an equal distribution of fruit. 4th. While the vine is restricted within certain limits, it is not dwarfed, as some might suppose; for a vine with two arms four feet long, with ten upright canes on each, making twenty canes three feet long, has sixty feet of wood to be grown and pruned off each season. This quantity is certainly abundant to give the most vigorous growers sufficient expansion to insure a healthy action of root. Some cultivators suppose that because a vine will grow large and occupy considerable space, if allowed sufficient time and furnished with plenty of nutriment, that it cannot remain healthy if it be restrained within moderate limits. But this is a great mistake, and the sooner such ideas are abandoned, the better it will be for the cause. 5th. The vines being trained low, the fruit receives a greater amount of heat than if more elevated, because it gets not only the direct rays of the sun, but also the heat reflected from the earth. This last is quite important in a northern climate, where there is little danger of getting too much heat. 6th. The mode is so simple that the most inexperienced may understand it; and when the vines are once put into shape, the pruning ever after is so nearly the same there is scarcely any danger of going wrong.

Fig. 50 represents a two-tier system of training upon the same principle. It is equally as good as the single tier of arms, but it usually requires one year more to perfect it, and the trellis must be made considerably stronger, as its height offers more resistance to the wind than in the former mode of low training.

It has one advantage over the other mode, as a larger number of vines are planted to the acre, producing, consequently, an increase in amount of fruit. It is particularly valuable where land is very expensive and labor cheap, and the greatest amount is desired from a given space. The vines are planted four feet apart in the row, and the rows eight feet apart, which gives 1,361 per acre.

When the vines are pruned for forming the arms, every alternate vine is cut back to within one or two feet of the ground, and the others at the height of four or five feet; the upper two buds on each one are allowed to grow, and from these the arms are made. Those that start nearest the ground are bent down for arms on the lower bar, and those at four or five feet are taken for arms on the middle or second bar; both sets are treated as directed for training a single vine. Sometimes those vines that are left four feet long will not produce canes sufficiently strong the first season to make the arms; if they do not, then they must be cut back a second time, or until canes are produced that are strong enough for arms.

The engraving shows the vine and trellis complete, except that only one arm is shown on the vines on the upper tier. The posts are eight feet apart, and they may be set opposite to every alternate vine, as shown, or midway between every other vine; it is better to set them between the vines, if the trellis is not built until after they are ready to train, because at that time it will be difficult to set the posts near the vines without disturbing the roots.

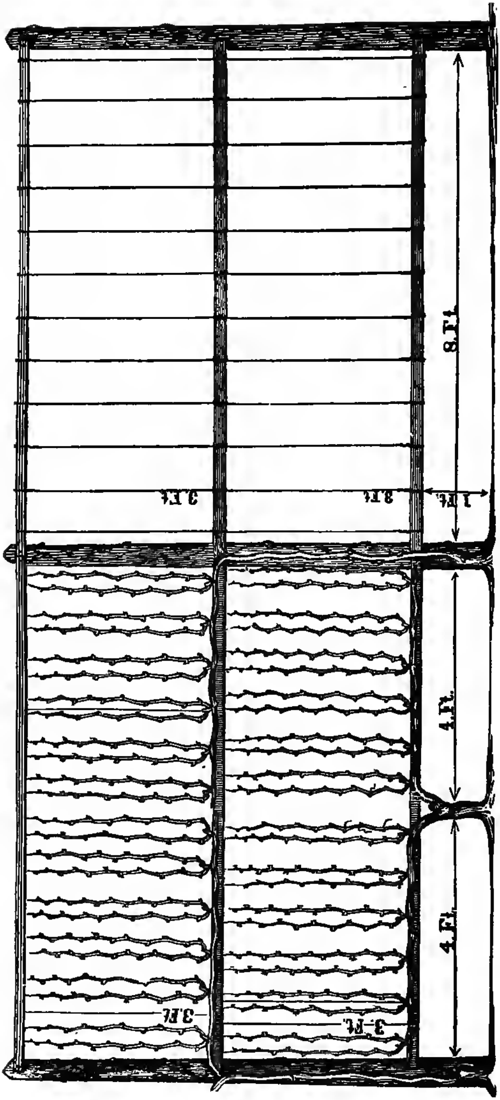

FIG. 50.

Each vine has but two arms, and the number of upright fruiting canes should be the same on each arm, the vines being treated, in every respect, as described for the single tiers. The vine at each end of the trellis will have but one arm, whether it happens to be on the upper or lower tier.

The trellis is represented as being seven feet high, the lower bar being one foot from the ground, and the other two three feet apart; this allows of three feet growth to the upright canes, which is sufficient for the strongest growers; but there are many varieties that are short jointed, for which two feet will do. And in locations that are low or very level, it is better to place the lower bar eighteen inches or two feet from the ground, so as to insure a better circulation of air among the lower leaves; besides, in some very fine soils, the fruit on the lower tier will get spattered during heavy rains, unless the ground is mulched. But there is no need of ever making the trellis higher than seven feet in a vineyard, and there is much inconvenience attending the tying of the vine on a trellis, the top of which cannot be reached while standing on the ground.

When it is desirable to have the lower arms more than one foot from the ground, and still reserve three feet space for the upright canes, it may be done in this wise: Place the lower bar two feet from the ground, the next three feet above it—we now have two feet remaining between the middle and upper bars.

The upright canes from the upper arms may be allowed to grow one foot or more above the trellis without support, and they will receive no harm therefrom. Where it is desirable to economize in every way possible, the trellis may be made only six feet high (provided the lower bar is placed at one foot from the ground), and the bars arranged so that the shoots from the upper tier may be allowed to grow above it.

Whenever any of the upright canes show a weakness, the pinching may be deferred until they gain the required strength. If the ends have already been pinched off, then leave two or three of the upper laterals to grow out for a foot or more, and this will cause an extra flow of sap into such canes, and thus we may check one cane and encourage another. In this manner we can readily control the forces of the vine, directing them to whichever part best suits our purpose.

In checking the growth of vigorous vines, especially when young, we will sometimes cause the main buds on the young canes to throw out fruit branches in the latter part of the season, and on these will appear a second crop of fruit. This, of course, is of no value, because there is not sufficient time for it to ripen, even if the strength of the vine would admit of its doing so. I mention the fact only because some inexperienced persons may be alarmed by seeing a second crop appearing upon the vine in autumn. This second crop is certainly produced from buds that would, under ordinary circumstances, remain dormant until another year, but checking the growth has forced them out before the proper time. If every main bud on the young canes is forced into growth except the two or three lower ones, no harm is done, for these last are all that are needed; the others we prune off at the end of the season. There is little danger of the lower buds starting, particularly on fruiting canes. I have often severely checked fruiting vines, sometimes stopping the young canes at the fourth bud, but even this did not cause the lower two buds to start. And when the canes are not pinched until they have produced their fifth to eighth leaf, as I have recommended as the general rule, then there is not the least danger of any of the lower buds pushing prematurely into growth.

If the young canes are allowed to grow unchecked, the lower bud upon them will seldom become sufficiently developed to produce a vigorous fruiting cane the succeeding year. That it should be so developed is all-important when vines are trained with horizontal arms and spur pruned, and in no way can this be accomplished except by checking the cane while growing.

To the novice this stopping of the young canes, tying, pinching laterals, removing tendrils, etc., may appear to be a tedious and expensive operation, and sometimes, when vigorous growing varieties are planted in very rich soils, it is so; but under ordinary circumstances, when the vines become fully established, very little trouble will be experienced upon this point.

The young canes will have to be stopped about three times during the summer, and at the time of doing this the laterals, if need be, should be pinched, and tendrils removed. On old vines the laterals will seldom need stopping more than once, unless they are overdosed with manure.

Opposite Arms.—In cutting back the young vines for the purpose of producing two shoots for arms, it is apparent that the upper two buds will not be exactly opposite, and that one of the arms will be higher than the other. This may be remedied somewhat by bending the short piece of two-year-old wood at the base of the upper bud; but this cannot always be turned at an angle so short that one of the arms will not be a little higher than the other. It is no great matter if it is, but when it is desirable to have the arms appear to start from the same point, the vine may be treated in the following manner:

When the vine is strong enough to make arms it should be bent down into a horizontal position, and tied to the bar of the trellis, all the laterals being stopped except the one at the angle near the bar.

Fig. 51 shows two vines upon a two-tier trellis; A, A, are the two laterals that have been allowed to grow unchecked. The bending of the growing canes will check the flow of sap in them, while the laterals, A, A, will grow very rapidly.

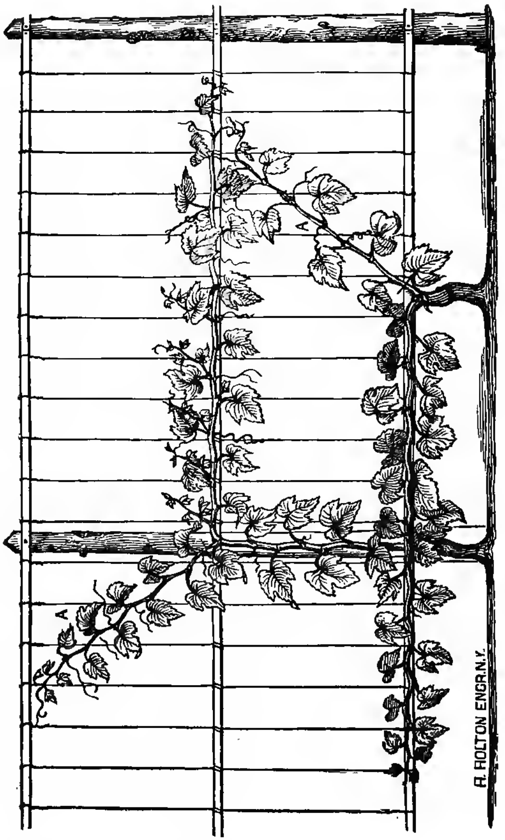

FIG. 51.

If the vines are vigorous and the canes are bent down in midsummer, the laterals will often grow sufficiently strong by fall to make the arms. If they do so, cut them off at four feet and tie them to the bars, the same as the main canes. The two arms will then appear to have started from the same bud. But if the lateral does not grow sufficiently strong to be used for an arm, it should be cut entirely away at the time of the annual pruning.

The main cane on the lower bar should be cut off where it crosses the vine next to it, and the cane on the upper bar at a point directly above the main trunk of the lower vine. If we fail to get an arm from the lateral the first season, we may allow the main cane to remain in its position, and permit so many buds to grow from it as we desire for the upright fruiting canes; but the bud which is at the base of the lateral, A, we will allow to grow up until long enough to make the arm, in place of that which we failed to get from the lateral. At the end of the second season we bend this down, and form an arm precisely as would have been done with the lateral; and the vine will appear the same, except that one of the arms is one year older than the other, and of course it is considerably larger. To remedy this difference in appearance, the upright canes on the two-year-old arm should be cut back to one bud, instead of two, as would have been done if both arms had been perfected the first year, allowing only single upright canes on both arms this season. The cane that is bent down the first season will usually produce fruit the second; but it is best not to let it produce more than one bunch upon each upright cane, unless it is very strong. The object should always be to subdue the vine, but not to weaken it, and if it is necessary to commence training it the first season after planting, it should be done; and it is far less trouble to get control of the vine while young, and there is less danger of injuring it than if we wait until it has spread its roots and branches far and wide before we undertake to confine it within certain contracted limits.

This fact should be borne in mind, that the expansion and multiplication of roots depends as much upon the extent and number of branches that are allowed to grow, as the growth of the branches does upon that of the roots.

Therefore to control the whole plant we have only to control the top, and this is done chiefly by checking the branches while growing, for if the vine is allowed to perfect its canes, it will certainly perfect a corresponding number of roots, each of which is capable of absorbing a certain quantity of nutriment, and sending it upward into the branches; and every year that the vine is allowed to grow unchecked, so much more does it increase the difficulty of bringing it under control.

Oblique Arms.—In many parts of the country the grape vine is not sufficiently hardy to withstand the cold of winter without protection, and there are very few locations in the Northern States where this would not be beneficial to many of the varieties now in cultivation. Even if the vine itself is not materially injured, the fruit buds are often so weakened by cold that they fail to produce as much or as good fruit as they otherwise would. With the systems of training that I have given, and others frequently adopted, it is not only inconvenient to protect the vines, but it would also be very expensive. There is no method of protection that is so cheap or practical as that of laying down the vines and covering them with earth; but to do this they must be trained in such a manner that they may be bent down without breaking the main stem, or otherwise injuring them.

When trained with the two arms they cannot be laid down without bending the main stem over to one side, which would be difficult to do, particularly after the vine has become large. The vine may be trained with one arm, and this could be laid down more conveniently than when there were two; but still it cannot be laid flat without bending the main stem, or straightening the angle which is formed in making the horizontal arm. To surmount all the difficulties met with in the common modes of training, and still continue upon the arm and renewal system; I have adopted what I call, for the want of a better name, the oblique system. The vines are planted three feet apart in the row, and the rows six feet apart; this allows 2,074 vines to the acre. The vines are planted in the same way as for other modes of training, and but one cane allowed to grow the first year. In the fall the vines are cut off to about four

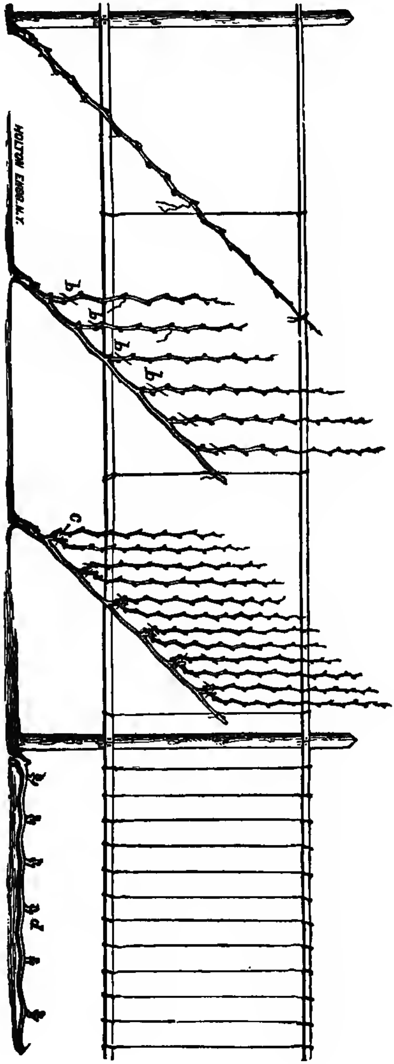

FIG. 52.

feet, and laid down and covered with earth—four or five inches deep is usually sufficient. The next spring remove the earth and straighten up the vine. Build the trellis in the same manner as described for low trained vines with two arms; that is, four feet high and three feet between the bars. Fig. 52 shows the system in its progressive stages. The vine on the left shows the one strong cane at full length; the next vine after it has been pruned, and with the single upright bearing canes; the third vine as it appears complete at the end of the third year; the fourth vine (*d*) shows the same, pruned and laid down ready for covering.

If good strong vines are planted, the system can be brought to completion in the third season; but strong and vigorous canes must be obtained, in all cases, before commencing the training. The vines are trained at an angle of forty-five degrees, and the bearing canes being perpendicular, they consequently make the same angle with the vine that the vine does with the ground.

This is the highest, or greatest angle, to which vines can be carried without giving the upper shoots on the arms so much the advantage over the lower ones that there will be no certainty of the lower ones pushing into growth without bending, or otherwise distorting, the canes.

We will suppose that, at the end of the first season, we have a vine as shown at the left of the engraving. It is then laid into position, as seen; we then cut it off at the point where it crosses the perpendicular wire, leaving it an inch or two beyond it, so that it can be securely tied. The cane, when cut off, will be about four and one-half feet long. It may now be laid down by the side of the trellis and covered with earth. In the spring take up the vine and tie it to the trellis; and to be sure of getting the correct angle, let the point where the cane crosses the lower bar and the point where it is tied to the upright wire be both equal distances from the base of the wire. The vine should be made as straight as possible, so that the sap shall not be checked in its flow. If it is not disposed to be straight, a lath should be nailed on, reaching at the proper angle from the lower to the upper bar, and the vine tied to it. When the buds start, select five or six for the upright canes, the same as when the arms are trained horizontally.

The first upright may start a few inches below the lower bar, as shown in the engraving, or the bar may be placed at six inches above the ground, provided the soil about the base of the vine is kept covered with mulch to keep the fruit clean. Each of the uprights will produce fruit, but unless the vine is very strong, a portion of it should be removed.

The flow of sap will sometimes cause the upper shoots to grow a little faster than the lower ones; if so, pinch off the ends so soon as the fifth leaf is formed on them, and leave the lower canes until they have eight or nine leaves. The growth of the canes will usually be very regular when the vines are laid in straight, and at the angle named. At the end of the second year the bearing canes should be pruned to two buds; the cross lines at *b*, Fig. 52, show the point where to cut off.

As the vines are to be protected, there is no necessity for leaving an extra bud to be cut off in spring, as recommended for unprotected vines. In locations where it is necessary to protect vines, the warm weather usually comes on so rapidly after it commences, that it would not do to prune the vines after they are uncovered.

The next season two canes are produced from the two buds, and in the fall the cane which starts from the upper bud of the two is removed, cutting through the spur, as previously shown, and the other cane cut back to two buds; the cross line at *c*, Fig. 53, shows the point at which it should be removed. Upon the right hand of the figure, and over the vine that is laid down, the trellis is shown as it appears with all the perpendicular wires. The trellis, as here shown, is only two

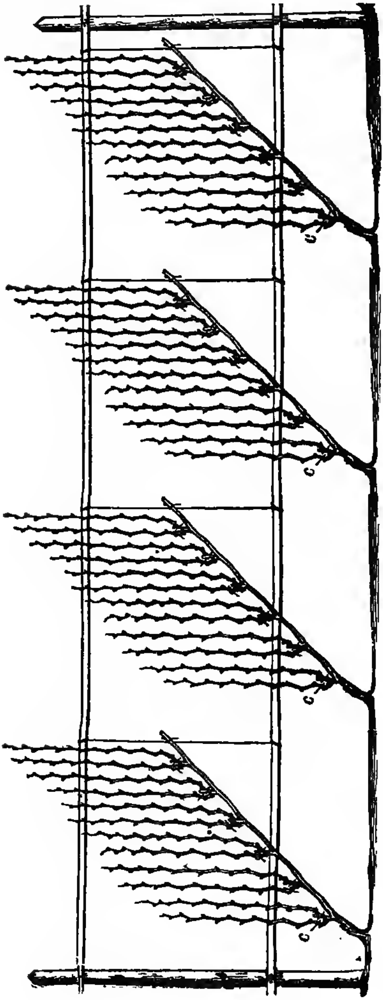

FIG. 53.

feet between the bars, and its whole height only three feet, the upright canes on the upper portion of the arm being allowed to grow above the upper bar. This they may be allowed to do when it is desirable to practice the strictest economy. Fig. 53 shows a space of twelve feet, as occupied with four vines trained with oblique arms; only two posts are represented, but it is best to place the posts not more than eight feet apart. When a row of vines trained on this system is pruned and laid down, the vines will overlap each other a little; but the end of one may be laid by the side of the trunk of the next, and so on throughout. In laying them down, one person should hold down the vine while another covers it, and as the vine has to be bent only one-half the distance that it would to be trained upright, there is no difficulty in laying it down quite flat. No straw or any similar material should be used in covering the vines, as it only furnishes a harbor for mice.

If the soil is so wet and heavy that there is danger of injury to the buds, a little sand should be put on next to the vine before the earth is put on. The buds will not be injured in any ordinary dry soil, provided the vines are not covered until the ground becomes cool, and are not allowed to remain in the ground too late in spring.

The three systems that have been described are the same in principle, only the details are varied to suit different circumstances, and these details may be varied indefinitely, so long as we do not undermine the foundation upon which the structure is built.

Wherever a variety is grown that is naturally unproductive, or one that produces so small a bunch or berry that it does not exhaust the vine in the same proportion that the larger varieties do, then one of the canes may be pruned a little longer, say four to six buds, it being at the same time bent over at an angle, so that the lower bud will be forced to produce a strong cane for another year. These modifications, to suit different varieties and circumstances, will suggest themselves to the vineyardist, if he will think as he works. It is impossible to point out every phase which the different cases will assume, particularly when there are so many varieties under cultivation, each of which has its own peculiarity of growth.

CHAPTER XVI.

GARDEN CULTURE.

The greatest obstacles in the way of cultivating the grape in gardens, particularly in cities and villages, are, the want of circulation of air, and the excess of shade, or both. Still, with these difficulties there are some advantages; protection from cold in winter, and greater heat in summer, which cause the fruit to ripen early, so that, upon the whole, there is about the same chance of success in city gardens as in the open country.

There are few gardens, either in city or country, where there may not be found a sunny spot sufficiently large to accommodate a few vines. It is often the case, in cities, that the only spot that the sun reaches in the whole garden is covered with a brick or stone walk. When this is the case it does not prevent the planting of the vine, as the walk may be taken up, the soil beneath it made deep and rich, the vine planted, and the walk re-laid, leaving the top of the vine coming out at one side. Or the vine may be planted on the side of the walk, and kept trained to a stake until it has produced one long stout cane. Then take up the walk between it and the building, or wall, on which we desire to train it, remove the poor soil and substitute that which is rich, for two feet wide and the same in depth, and lay down the vine in this, bring up the cane on the other side, and replace the walk.

This is a much better plan than to place the roots near or against the foundation of a building, because in such a position they usually receive too much heat in summer and are too wet in winter.

The roots of the vine will grow almost as readily under a pavement as anywhere, provided the soil is not too wet; the surface of the soil being covered, it seldom becomes dry, and the pavement absorbs a great amount of heat, which passes through it to the soil, furnishing sufficient to keep up a healthy action of the roots. The most important thing, in preparing a place for a vine, is to secure proper drainage, because where there is much shade the soil is usually very wet; and to avoid injury to the roots from excess of moisture, deep trenching or drainage is indispensable. It may not always be necessary to dig very deep at the exact point where the vine is to be planted; in fact, this would more often be injurious than otherwise. But let the deepest digging be at some distance from it, so that the water, as it descends, may be carried away from the vine, instead of being drawn under it.

One of the most common errors committed in tree, as well as vine planting, is that of digging deep holes at the point where the plant is to be set, and then filling them up with loose soil, and in this place the roots. These holes only serve to drain the surrounding soil, receiving moisture instead of repelling it. This would certainly be beneficial in very porous, dry soils, but in wet ones it is injurious. If the ground can not all be trenched, let the holes be made large, and at the point where the vine is to be set, not more than eighteen inches deep, and, at the outside, two feet deep; this will cause the water to settle away from the vine. When the soil is very heavy, it is best to dig a trench and set the vine at one end, letting the bottom of the trench descend from the vine to the farthest point; any old rubbish, such as brick, stone, bone, etc., may be placed in the bottom of the trench to secure a better drainage. When a number of vines are to be planted, a long, wide, and deep trench should be made and filled with good soil;

this will make what is usually termed a *border*. Four feet wide and two feet deep will answer every purpose, unless the method of training to be adopted requires the vines to be planted very near together; if so, then it may be necessary to make the border six or eight feet wide.

When the border is first made it should be a few inches above the level of the surrounding surface-soil, as it will usually settle, and frequently require a considerable addition of soil to prevent it being too low. If the border were made only level with the surface of the garden, when it settled it would carry the vines down with it, and when filled up, the roots of the vines would be buried too deep. When an outlet can be secured, either into some hollow or sewer, it is well to lay a drain along the bottom at one side of the border. This drain may be made of tile, brick or stone, and should descend, at least, one foot in a hundred, to secure the rapid passage of the water.

Drains made of stone should be covered with sods, straw, wood shavings, or some similar materials, before the trench is filled, as these will prevent the fine soil entering and filling it up. In wet and heavy soils it is a great point gained to secure a thorough and permanent drainage.

The materials used in making the border may be the same as are used in the vineyard, but as they are not always to be had, others may be used, avoiding always all fresh, unfermented manures. If old manures cannot be had, make the border entirely of soil, and if clayey, add sand; use ground bones and charcoal to put around the roots when first planted, and then apply the fresh manure to the surface, forking it in after it has become rotted. A little lime, plaster or ashes may be added to the border, but not in any great quantity, as there is more danger of applying too much of such materials than too little. There is usually an abundance of materials about a city or village that may be used for manure, but most of them should be used with caution, as it is difficult to determine what injurious ingredients they may contain. It is much the safest way to use stable manure, when it can be had, or, in place of it, ground bones, poudrette, etc., adding sods, leaves, or charcoal, as much to lighten the soil and make it more friable, as for their fertilizing qualities.

One of the most pernicious practices in cities is the continual drenching of the grape borders with slops from the house; this has become common from the well-known fact that they often contain a large amount of manurial ingredients. But the large amount of water accompanying them usually renders them more injurious than beneficial. An occasional application of this kind may be of service, if the borders are well drained; but a better way of saving such materials is to dig a hole or make a cistern in some out-of-the-way place; then add charcoal or dry muck sufficient to absorb the moisture, and when the place becomes filled, take out the manure, add a little plaster, and then it is ready for use. In this manner it becomes deodorized, and is really an excellent manure for the vine.

There is one other point upon which a word of caution may not be amiss, namely, not to apply top-dressings of strong manures in summer, for this will usually cause the vines to produce a late growth, which it is always desirable to avoid. The best time to apply a top-dressing is in the fall, as it then serves to protect the roots during the winter, and the fertilizing materials are carried down by the rains, and are ready for use when the vine starts in the spring, and a steady, uniform growth is insured. It is not advisable to grow any plants except the vines in the border; but where there is a scarcity of room, a few bulbous-rooted or annual plants may be grown. If they are of the latter kind, it is best that they should be trailing plants, such as verbenas, portulaca, etc., as these spread over the soil and operate, in a measure, as a mulch; still, they absorb more moisture from the soil than their shade assists in retaining. No deep-rooted perennial plant should be planted near the vine. Neither should large shrubs or trees be placed where they will continually shade the ground, for the roots of the vine, as well as the branches, require warmth.

Position of Border.—The position of the border will depend somewhat upon that of the garden; but any exposure except a direct northern one will do, and even this will answer, provided the place is not in the shade more than half the day. The best position, however, is upon the south side of a building, or high fence, or wall. An eastern or western exposure will answer every purpose, because the heat and light are far more intense in such positions than in the open vineyard.

Training the Vines.—When the vines are grown in large open gardens, where there is plenty of room, the same general system of training may be followed that has been given for the vineyard. The two-tier system, as shown in Fig. 50, is preferable for garden culture to any of the others, except in more northern sections of the country; then the oblique arm is the best.

Circumstances, however, will often occur, when it will be necessary to deviate somewhat from any of the plans given, to better suit the particular location in which we are obliged to plant. These variations may be innumerable; still, if no fundamental principle is interfered with, success is just as certain as though the plans laid down were strictly followed. For instance, we have endeavored to show that vines are more productive and yield better fruit when trained horizontally than perpendicularly; but it will make very little difference whether the arms are three feet long, or thirty, provided they are not extended too far in any one season.

Neither does it matter whether the arms start from one foot above the ground, or at ten, so far as principle is concerned; but when it is desirable to produce arms at a great height, we must do it gradually, and not endeavor to accomplish it in one season. In the vineyard, the best possible position for the arms may be one foot from the ground, while in a garden surrounded by high walls, ten feet might be far better than any point below it.

It is, therefore, impossible to give a plan that will suit every position; but the horizontal arm should be

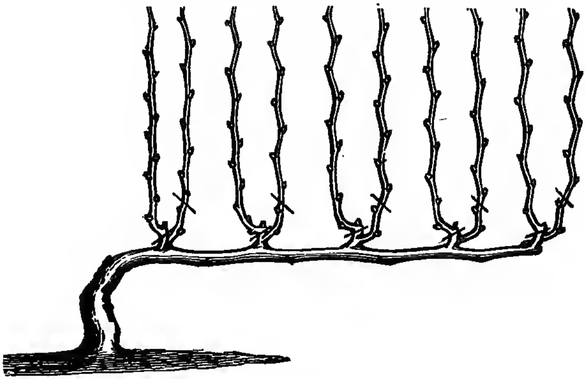

FIG. 54.

the main point aimed at, whether it be long or short, high or low. The vines may also be trained with only one arm instead of two.

Fig. 54 shows a vine with one arm having only five spurs, but it may be extended by bending down the right-hand upright cane, and in this manner the arm may be lengthened as required. The season previous to extending the arm the end cane should be allowed to grow four or five feet long, instead of stopping it at the usual height, so as to have a strong cane to lay down. Three to four feet is about as much as should be added to the arm in one season, for if a cane of more than four feet is laid down, some of the buds will often fail to grow. The vine may be planted, if need be, several feet from where we wish to train it, and the arm be allowed to extend that distance without producing upright canes, as it will make no difference in the result whether the sap flows through one or ten feet before it reaches the leaves.

Four Tiers of Arms.—Sometimes it is desirable to fill a certain space which is higher than would be occupied by two tiers of arms; if so, plant the vines only two feet apart, instead of four, and form four tiers in the same way as we formed the two tiers. Or two tiers of arms may be formed from one vine, although it will take a year or two longer than it would to plant more vines, and only take two arms from each one.

Fig. 55 is a very correct representation of an old Hartford Prolific vine, with two tiers of arms from the same vine. The arms are eight feet long, so that the vine covers a space sixteen feet long and only six feet high. There are ten spurs upon each arm, making forty in all, giving eighty upright bearing canes, and it is allowed to bear from two hundred and fifty to three hundred bunches annually. One season it produced two hundred and fifty-six bunches.

I have introduced this vine here for two purposes: First, to show how an old vine that has been grown without any system of training may be brought into a good form; and second, that I may more thoroughly impress upon the mind of the reader the importance of training vines with horizontal arms, for the purpose of improving the quality of fruit as well as controlling the growth of the vine. Having an old Hartford Prolific vine in my garden, the fruit of which could usually be shaken off so soon as ripe, I thought I would try and see if the arm and spur system would have any effect upon it, and in any degree remedy this defect.

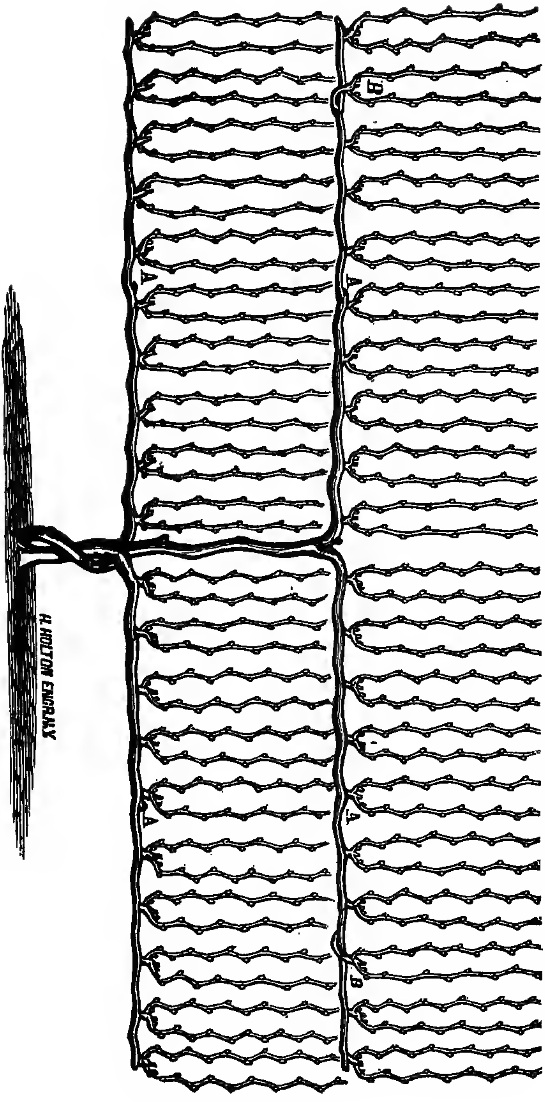

FIG. 55.

It was, until destroyed, as shown in the engraving, and the fruit not only improved in size and flavor, but it adhered so well to the stem, that I have kept it for two months after picking, and still the berries would not fall from the bunch if handled carefully. I do not attribute the improvement in the fruit entirely to the horizontal arms, but only in part; for, without doubt, the spur pruning and the close pinching of the young shoots assist very much in the development of the fruit. The method used to obtain these arms was as follows:

The season before I attempted to train it I cut the whole vine back to within about three feet of the ground, and let it produce new shoots from whatever part they happened to come. It being an old, untrained vine, as I have stated, it produced several very strong young canes, and I cut away all but four; the two upper ones started about three feet from the ground; these I cut off to four feet, and laid them down horizontally; they reached to A, A. One of the two lower canes sprung from the old stem, about one foot from the ground, and just where it was wanted for the lower arm, but there was no young cane opposite to form the other. There was, however, one that came out from near the roots, and this was used for the other lower arm, by twisting it around behind the old stem, and bringing it down opposite the first arm; the two arms were then cut off at A, A. The lower arms were trained on the same level, although one of them came out a foot or more below the other. This makes no difference, except in appearance, as it does not matter whether the arms start from buds nearly opposite or not; all that is requisite is to bring them to nearly the same height before they are allowed to produce leaves or fruit. The next season the two end canes were allowed to grow long enough to lay down and extend the arms to their full length. In selecting the buds for upright canes, I reserved some of those on the under side of the arm; the canes from these bear fruit just as well as those from the upper side.

I would not recommend this mode of training for vineyard or garden, except in cases like the above, where it is desirable to bring an old, strong vine into the arm system, and the owner has plenty of time, and desires to exercise his skill in bringing the vine into such a form. Vines that have been trained with only two arms may, after they become old, be allowed to produce an extra tier, but the sap will usually flow with greater force into

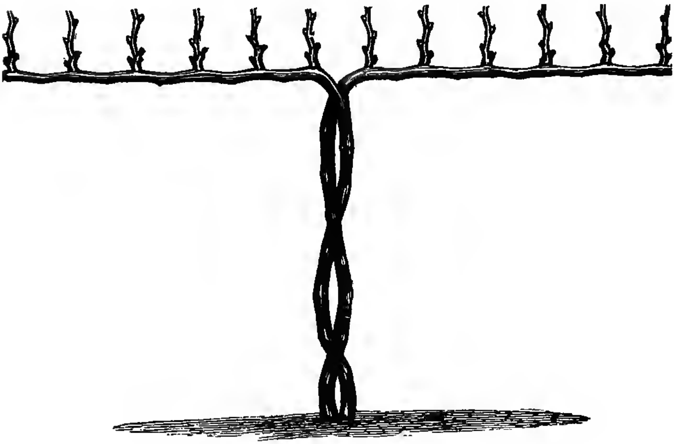

FIG. 56.

the upper arms, and necessitate the checking of the canes on them sooner than on the lower ones. To produce a second tier of arms upon a vine having only one tier, the bearing cane nearest the center is allowed to remain at the time of the annual pruning, and the end cut off at the point where it is desirable to have the arms start. The next season the upper two buds on it are allowed to grow for the arms, and the following season they are laid down for a second tier.

Double Stem.—A few years since I had some vines growing in a border on the south side of a wall. They started so early that most of the young shoots were cut off by a late frost; consequently the buds which I had selected for arms were destroyed. The vines being young, new shoots started from below the ground. I cut away all the old stem, and selected two of the strongest shoots that came up, and cut off the others. These two shoots were kept tied to a stake during the season, the laterals pinched, etc. The next spring the two canes were laid down for arms; those for the upper tier were twisted around each other, and then laid down and fastened to the middle bar.

Fig. 56 shows one of these vines when it became well established. Accidents will often happen in vineyards, as well as in gardens, rendering it necessary to have recourse to some such plan to restore lost arms without loss of time. This is perfectly practicable, and the final result will be as satisfactory as though there had been no interference with the plan laid down at the beginning. Many other variations from the usual course of proceeding might be given, but I have mentioned enough to show that a general principle may be taken as a guide in grape culture, and still be varied to suit the different circumstances attending it.

Trellises in Gardens.—The same form of trellis described for vineyards may be used in the garden, varying it in length, height, etc., to suit the position in which it is placed, as well as to meet the wants of any particular vine. A trellis is indispensable, as the vines should never be fastened directly on the side of a building or fence, but should be, at least, six inches from them; a foot is still better, as this allows a free circulation of air behind the vine, and prevents, in a great measure, the burning of the leaves, which usually occurs when vines are laid against the boards or wall. Besides, the surface on which the vine is trained will soon become defaced by the constant rubbing of the leaves against it, while the accumulation of dust and moisture will cause the rapid decay of the boards; and even a stone or brick wall will be injured more or less by having vines trained against it. If the trellis is suspended by iron or wooden brackets, no apparent injury will be done to the surface behind it.

Training to Stakes.—There is seldom a garden so small but there is room for, at least, one grape vine, though it is often the case that there is a place for a vine but no room for a trellis; when this occurs, the vine may be trained to a stake, or a number of them; and when so trained they may be planted among shrubbery, in flower beds, or upon the lawn. There is nothing that will add more to the beauty of the garden, or produce a better effect, than vines planted in groups or scattered here and there, as is usual with ornamental shrubs and plants. The vines, in such situations, should always be kept low, and never permitted to produce long and naked stems, which would become unsightly and mar the beauty of the garden when they become old. Prepare the soil as for vines in other situations, and grow but one cane the first season; then prune it down to eighteen or twenty-four inches from the ground; the next season allow but two canes to grow; pinch off the tops of these when they have grown five or six feet, so that they shall not only ripen their wood,

FIG. 57.

but become more stocky. Fig. 57 shows the vine with two canes at the end of the second season. If the vine

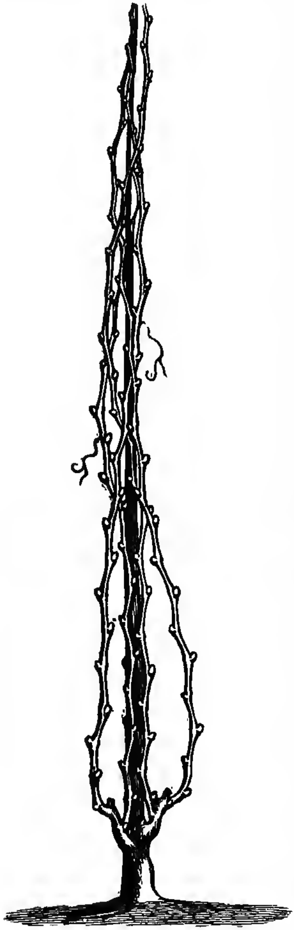

FIG. 58.

was large and vigorous when planted, it will usually produce fruit the second season; if so, pinch off the top of each cane when it has grown about two feet; this will assist the development of the lower leaves, which are so important to the proper development of the fruit. When they have started and grown a foot or two more, stop them again, they will usually need checking several times during the season. The canes should be neatly tied to a stake, and the laterals may be allowed to grow a foot or more before being checked, as they assist in hiding the stake, and their own weight causes them to slightly droop, giving a more pleasing effect than when all are kept tied close; for when vines are grown in a flower garden we endeavor to combine the ornamental and useful. The third year the vine with two canes should be cut back to two buds each. From these buds we produce four shoots, each of which will usually bear three to five bunches of fruit, so that we have from twelve to twenty bunches on the vine. Fig.

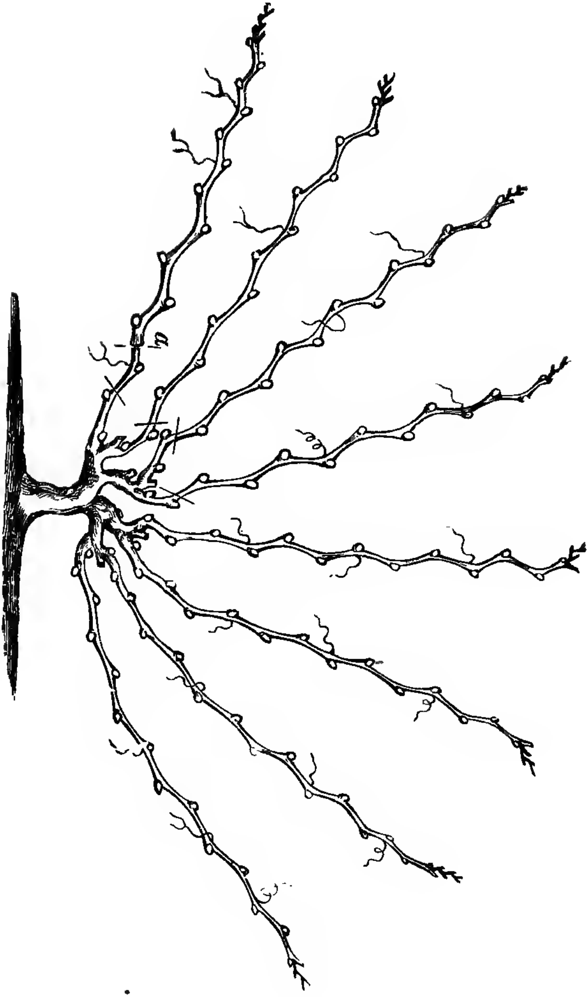

FIG. 59.

58 shows the vine with four canes, as it will be at the end of the third season. The vine may now be pruned in the same manner as before; that is, each cane is cut down to two buds, and eight canes be allowed to grow the fourth year; or two may be cut entirely away, and leave but two buds on the others. If eight canes are produced they will require one additional stake or a trellis, so that they may be spread out and give a better opportunity for growth. Fig. 59 shows the vine with eight canes, as it appears when trained on a trellis.

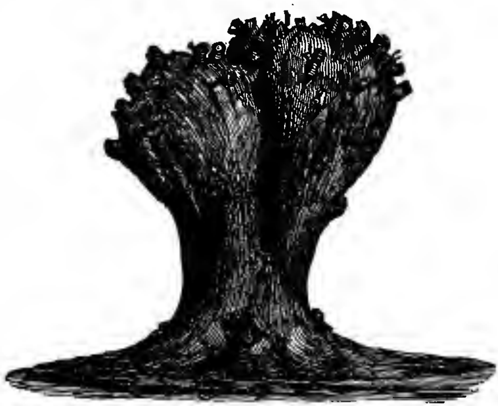

FIG. 60.

This vine may be again pruned in the same manner, and twelve or sixteen canes allowed to grow; and this is essentially the same system practiced in some of the vineyards at the present time, and it answers very well if a portion of the canes are cut away each year, so that they will not become too much crowded.

The system, when carried to the extent of thirty to forty canes, becomes quite complicated, and it is difficult to distribute the fruit so widely and evenly as when the vine is trained with arms. But when the vines are grown in small gardens, four or six canes are as many as should be allowed on those trained to stakes.

There is no difficulty in keeping the vines within a small space, and with the main stem only a foot or two high. All that is necessary is to keep the young growth checked during the summer, and when pruning the vine leave only those buds which are required to produce fruiting canes.

I test all the new varieties in this way, never going to the expense of erecting trellises for them until they have proved themselves worthy of it. The vines will

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and bear fruit

vines in this country, nor is there any necessity for ever having any, because there are better plans in use; but there is no reason why our indigenous varieties may not be dwarfed as well as the European kinds. Fig. 60 shows one of the old vines of Europe. This vine represents what is termed "head pruning;" the vine being pruned in close to the stump every year, and the accessory buds are mainly depended upon for producing the bearing canes.

Fig. 61 shows another form, which is called "buck pruning." The head is allowed to divide into several parts, thereby allowing it to produce more fruit than upon those that are pruned to one head. This is an old Hungarian mode, and it is still practiced in many parts of Europe.

If the reader will refer to Figs. 44, 45 and 50 he can see, at a glance, the improvements which have been made in the form of training the vine, from the days of the ancient Romans down to the present time. And it will be readily seen that they are all founded upon the same principle, the only difference being that the top of the vine is extended more in one than in the other. They are all pruned on the renewal system—that is, all the young shoots are cut back every year.

Within the range of these four plans and their variations are comprised all the successful systems that have ever been invented. The head pruning is practiced upon the poorest of soils, and the buck pruning on soils that are only moderately rich, and the other two upon rich soils, and with the strongest growing varieties.

There is, however, a system of training in use in Lombardy that differs from any of those given; but it should not be called an artificial system, because the vines are allowed to grow upon trees, as they would in their wild state, no particular method of training or pruning being adopted. The vines bear as well as they would in their wild state, but the process is a slow and tedious one at best.

Girdling the Vine.—This operation, though often producing remarkable results, is still of questionable utility. That it causes the fruit to grow much beyond its natural size is certain, but the quality is never improved, and usually very much injured. The practical results of such an operation seem to be, to cause the fruit to assume the appearance of ripeness much earlier than it would otherwise, and become so much increased in size as often to take the prizes at horticultural shows, where the judges are often influenced by appearance instead of quality. Many a *dropsical* cluster of grapes has been awarded a premium over the rich, well-ripened cluster of the same variety, merely because it had a fine appearance. But some of our leading horticultural societies now notify exhibitors that grapes from girdled vines will not be allowed on the exhibitors' tables.

The girdling may be done at any time in the spring after the vine starts, up to the time the fruit is fully grown. But unless it is done several weeks before the fruit commences to ripen, it will have but little effect. The best time to perform the operation is just before, or soon after, the fruit is set. The mode of operation is as follows: Cut away a ring of the bark, from one-fourth to one-half inch wide, clear to the true wood. It may be performed on old wood, or upon the young canes when they have made a foot or two of growth, but the last year's wood is preferable, and it should be done only on that which you intend to prune away.

The incision is always made below the bunch which it is desired to affect. The bunches above the incision become much larger than those below it; this is said to be caused by the obstruction of the downward flow of the sap to the roots.

The practice of girdling the vine for the purpose of affecting the fruit is supposed to have been invented about 1745, by Col. Buchatt, of Metz, in France. For this he was awarded a premium by the Agricultural Society of France. It was claimed that the invention would be of great value in hastening the maturity of the grape, as well as improving the quality; but it is doubtful if either of these results has been obtained in its practice.

Removing the Leaves.—There are many persons, in cities especially, who are in the habit of removing a portion of the leaves from their grapevines just before the fruit begins to ripen, for the purpose, as they say, of hastening it. This is, perhaps, one of the most absurd ideas that could be possibly entertained, as the grape ripens better in the shade than when exposed to the sun; besides, the ripening process is conducted almost entirely by the leaves, the grape being one of those fruits that must be ripened on the vine or not at all; and if it is picked before ripe, the process is immediately stopped, there being no further improvement in flavor. If the leaves near the fruit are taken off, ripening is not only checked, but often entirely stopped.

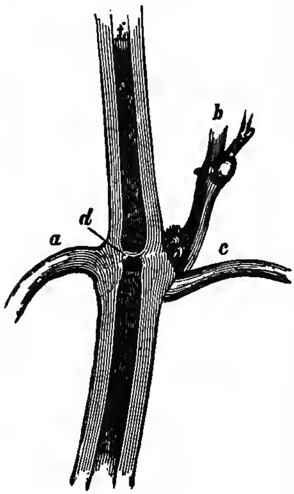

FIG. 62.

The fruit that is exposed to the direct rays of the sun after the leaves have been taken away may change its color, but it seldom ripens. It is not only necessary that there should be good healthy leaves on the fruiting cane, but they should be near the fruit. Every one who has seen grapes upon the vine must have observed that there is always a leaf opposite to every bunch of fruit;

that this leaf is of great importance to that particular bunch is certain. In Fig. 62 the connection between the two is shown; *a* is a portion of the stem of a bunch of fruit; *c* is the leaf-stalk; the pith is shown in the center, being the broad, dark line running lengthwise of the cane; this occupies more than one-third of its diameter, but is divided at *d* by wood which unites the two sides of the stem. Now whether the sap crosses directly through the young cane from leaf to fruit, or around the pith, is not positively known, but that there is a connection between them by which the fruit is benefited, can be readily demonstrated by removing the leaf early in the season. When this is done the fruit is not so perfect as when it remains.

This imperfection is not altogether owing to the loss of shade which the leaf afforded, because if the same amount of shade is given the fruit artificially, it is still more or less affected. If the lateral (*b*) remains with a leaf or two upon it, the injury to the fruit is not so marked, because its leaves perform, in part, the functions of the one removed. One great object, in pinching off the end of the growing canes, is to cause the leaves to grow larger, thicker, and better able to assist in perfecting the fruit; therefore, the main leaves on the stem should never be removed, and especially let those that are near or opposite the fruit be carefully preserved.

CHAPTER XVII.

VARIOUS SYSTEMS OF PRUNING AND TRAINING.

In giving a synopsis of some of the most prominent modes of training the vine, I shall not attempt to describe them at length, nor go into the minute details which may be necessary in the perfection of any of these systems, but only aim to show the general principles involved. It may also be well to emphasize this reference to principles which govern and control the growth of the vine, for they are not only fundamental, but universal, and we must submit to them whether we would or no, or whether our vineyards are located in Europe, Asia, Australia or America. Of course, we may modify practice, and prune long or short, high or low, give the fruit much or little shade, corresponding with the natural habit of the varieties under cultivation, as well as the exigencies of climate and soil, provided we keep within certain limits and do no violence to principles involved in the growth and production of fruit on plants under domestication. That error will often accompany truth, and creep in among the most simple plans, as well as among those that are intricate, is quite certain; and when, at last, the error is discovered, we wonder that it could have remained so long hidden under so slight a covering.

If we examine the various systems of training of the vine that have been in use for the last two thousand years, we cannot fail to see that very little real progress has been made, for all of those which have continued in use for any length of time appear to have been founded upon what we of the present time call the renewal system—that is, the young canes are cut back every year, and from buds on these are produced, not only fruiting canes, but other buds, from which fruiting canes will again be produced; and thus two things are kept in view, fruit this year, and fruit buds for the next, and both in close proximity. By this method the vine produces an annual crop, never resting longer than nature designed it should; as nature seems to have appointed a period for rest and for labor for all the members, of both the animal and vegetable kingdom. But with this known fact, so apparent to the observing mind, there seems to have been men so anxious to assist nature, that they overstepped her laws and endeavored to give her a longer period of rest at one time, and more work at another than she required, and in this way the *alternate* renewal system of training the vine was invented. Although this system of training may be, in some of its various modifications, quite successful, the principle upon which the whole structure rests is an erroneous one, and if the same is transferred to the animal kingdom, we might claim that the best way to treat a horse would be to allow him to remain in perfect idleness one year, and then work him up to his utmost strength the succeeding one. It is true that a kind of half alternate renewal system has long been practiced in some of the various forms of training the vine, as, for instance, the arms, or larger bearing canes are renewed every alternate year, or at longer periods, but there is no year of rest in these, for after the vine has reached maturity it is expected to produce an annual crop of fruit.

In the first edition of this work I gave considerable space to a description of a system of training the vine, introduced by the late William Bright, of Philadelphia, to which he gave the name of Single Stem Dwarf, Renewal System. In this system the inventor attempted to renew the whole vine instead of a part of it; but a few years later Mr. Bright admitted that the system wound itself up at the end of the third season, as I had predicted; consequently nothing more need be said about it here.

Another of these imaginary and impossible alternate renewal systems of training is shown in Fig. 63. In this it is proposed to renew the upright canes growing

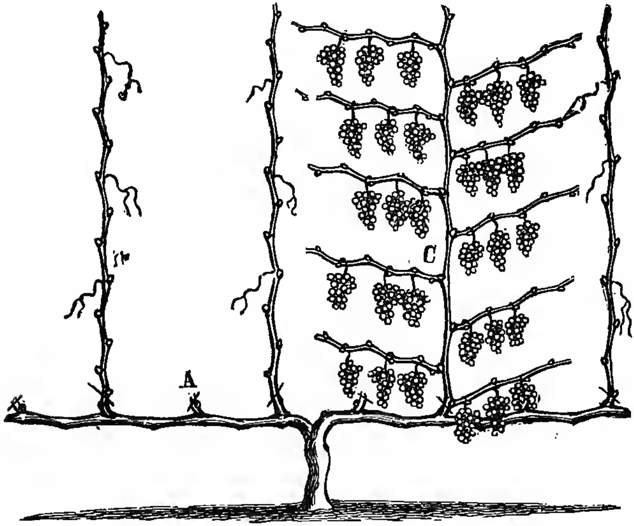

FIG. 63.

from horizontal arms, and in the same way that Mr. Bright proposed to renew the canes from the main stem near the roots. In brief, it is proposed to start eight or more upright canes from the two arms, and at the next season's pruning cut down every alternate cane at *A*, leaving the other canes, *B*, for producing fruit from the lateral new shoots, supposing the bunches would be produced as shown at *C*. But, unfortunately for the system, at the next pruning there would be no buds from which to produce new bearing wood at the base of the cane, *C*, and the vine would become an almost worthless stump. I should not have thought it worth while to again refer to this old and unscientific mode of training vines, had I not noticed several similar ones recently described in essays on grape culture, reminding me that ideas, however absurd, often attain a great age.

In one very large work published only last year (1893), I find an illustration of what is called a "Renewal System," but in the vine represented the annual canes spring from two arms, as I have shown in Fig. 44,

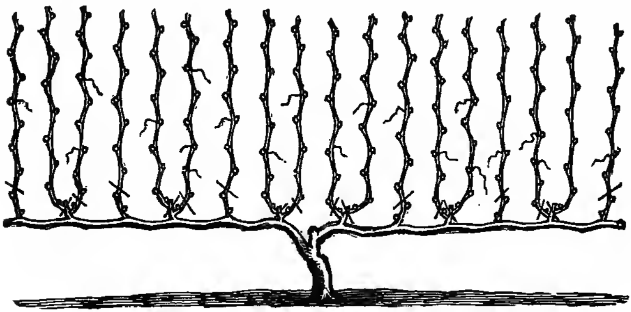

FIG. 64.

on a preceding page; but only alternate canes are shown as bearing fruit in this new renewal system. There is, however, no explanation of the why or wherefore of such a system of training, in the book to which I refer, and I can only account for the alternate fruiting canes, except upon the supposition that the inventor thought it was better to allow five canes to bear the entire crop, than to distribute evenly among nine. But the difficulty with all such systems is, that the vine is thrown out of balance, and the sap is drawn into the barren canes, to the detriment of those producing fruit. A similar unequal distribution of the sap will occur where one cane is left with ten buds when pruned, and another with but one, for the ten will have the advantage, although those unacquainted with the growth of vines might suppose the results would be quite the opposite.

There are various other systems of training in which the alternate renewal is the main feature, or is a part; but it must be apparent to every one who has ever studied or practiced vine growing, that the less alternate renewal there is in any system the better. It seems to be very difficult to eradicate the idea that one portion of the vine requires a partial rest, while another part is, perhaps, performing more than its due proportion of work, and thereby throwing its forces out of balance.

Fig. 64 shows a vine trained with horizontal arms, but with alternate single and double fruiting canes; this is almost the alternate renewal, though at the first glance it would be taken to be a strictly renewal system. The cross lines near the base of the upright canes will show where they are to be pruned to keep up this plan. On the double spur one of the canes is to be cut entirely away, and the other to one bud, and the single cane is cut off at two buds, and where there are now two canes, next year there will be but one; and the single cane of this season will produce two canes the next, thus alternating each year. This plan seems to be a very plausible one; but when we come to try it, we find that the spurs with two buds are inclined to grow more rapidly than those with only one, for the simple reason that the sap is drawn to that point with two-fold greater power than to the single bud. If all were pruned to one bud, then the sap would be drawn to all alike; and the same would be the case if all were pruned to any other number, from one upward. A hint upon such points as these will, I think, be sufficient, for it is a very easy matter to try pruning a few vines upon both plans before fully adopting either.

Munson's Alternate Renewal System.—Prof. T. V. Munson, in giving his system of training the grape to the public, through the pages of the *American Agriculturist*, in 1890, page 265, says: "To obtain best results, American vines generally require 'alternate renewal' of bearing wood and few long bearing arms." Then follows a description of the system, which begins with the building of the trellis, probably because it is the only new and distinctive feature, consisting mainly in the setting of two posts in the same hole, and these every thirty-two feet in the line of the rows of vines. These two posts, instead of being placed in an upright position, are set flaring outward at the top, so that they will be about two feet apart when fixed in place. Now along these two posts No. 11 galvanized wires are stretched, and both at the same height (four feet) from

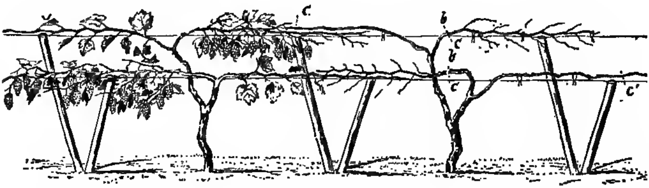

FIG. 65. THREE-YEAR-OLD VINE.

the ground, these two wires forming a kind of open, flat platform, or trellis, on which the vines are allowed to spread out over and rest when they reach a bearing age, as shown in Fig. 65. The vines are planted eight feet apart along the line of the trellis, and the first season the young canes are led up to the vines on strings provided for the purpose. When this young cane has reached the wire the head is pinched off, and two of the terminal buds are allowed to push out and form lateral canes for arms. The next season these side shoots are pruned back to near the point where they first touched the wire, or we may presume even lower if of weak growth, although Professor Munson is silent on this point. We gather, however, from his illustration of the system, that eventually two arms are trained on each wire, as shown, and then one-half of these bearing arms is cut away annually, to be replaced by new ones formed by laying down strong canes of the preceding season's growth, as practiced in the old German bow system, explained elsewhere. But as Professor Munson says nothing about thinning out canes, rubbing off surplus buds, summer pinching or pruning, we presume nothing of the kind is practiced, leaving the bearing and barren canes to go through the season in a great tangle on the two-foot-wide platform overhead. This system would not be a bad one, provided the same rules of pruning, thinning and pinching of the young canes are adopted, as practiced in all others of like form and character. As might be expected, the originator advances various reasons why he thinks it superior to all others in use; but there is only one which strikes me as peculiar, and deserving of special notice, and it is No. 3, in the list of his baker's dozen, to wit: "The sap required to make new wood for bearing is not carried through wood bearing a crop, as in the spur system, but a complete alternate renewal is effected, thus keeping the plant in perfect balance and meeting the natural requirements of the vine."

This is a most extraordinary claim, for if cutting away one or two entire bearing arms on a vine, and leaving the same number with numerous fruiting buds, will insure a "perfect balance," then, I must confess, something new has been discovered in the physiological principles which govern the growth of the vine. Then, again, any form of alternate renewal which starts above the main cane is not "complete," because this main stem, or stock, is just as truly bearing wood as an arm, whether it be long or short; for, at most, the arm is only an extension of the head, or upper part of the vine, and all the sap from the roots flows through this old wood. If all the arms, whether their number be few or many, are pruned to equal lengths, and the buds reduced to an equal number on each, we might claim something like a "perfect balance," provided that all the buds were at the top of the vine and on the same level. This is the true principle upon which all successful systems of training and pruning of the vine have been founded, in all ages and countries where the grape is known to flourish. It makes but little difference, in practice, whether we prune our vines down to a stump two feet high, and keep them there for one or one hundred years, as so long practiced in Europe, in what is called the "buck pruning," or train them up on trees or the rafters of a grapery, on the "long rod system," or lay down the canes and form permanent arms, as in the "Thomery system," one and all will produce equally as good results; the only difference consists in the adaptation to locations, soils, climates, and the convenience of the cultivator.

In early life I was somewhat inclined to believe that our indigenous native species of the grape might rebel against the restricted growth to which the varieties of the European species have so long been subjected, and to test the matter practically, I selected a few vines of our most rampant growing native varieties, with which to make experiments. The first of these was a Clinton, which all my teachers and later associates declared would not submit to close pruning. However, I selected a strong vine, and the first season cut the main stem down to about four feet from the ground, and then tied it to a strong stake. Every year since it has been "buck pruned," not more than one or two buds at the base of the long canes being left to produce fruit and new canes. It has never failed to produce an excellent crop of fruit annually, and now, in its thirty-fourth year, it is as vigorous as ever, with every appearance of remaining so for a hundred years, provided it is pruned in the same way and given moderately good care.

A few years later I planted a row of Concords and Hartford Prolifics, setting the vines four feet apart in

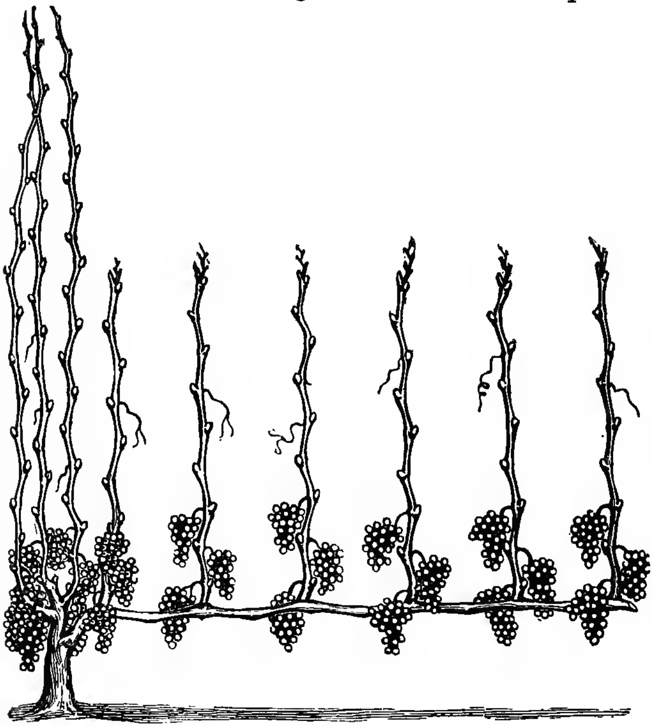

FIG. 66.

the row, driving a strong stake by the side of each, to support the main stem. These vines have been closely buck pruned from the very first year (1870), but I fail to see that there is any diminution in vigor, health, productiveness, or in the size and quality of their fruit.

Of course, thinning out of superfluous canes and buds has always been attended to, but beyond this the vines have been allowed to ramble freely, forming a rather intricate network of bearing canes direct from an old stump, through which the sap seems to flow just as freely as it does through the younger wood above, or as it will through an arm of the same age.

Single Arm System.—This mode of training the vine appears to be of German origin, and is founded on Professor Munson's idea that the extension of the head, or arm of a vine, should be renewed every alternate year, as shown in Fig. 66. In this system the vines are set about four feet apart, and are trained in the same manner as in the two arm system, until the time of forming the arms; then only one cane is laid down, and the others cut to three buds. When the buds push, four to six are selected upon the arms for upright canes, and the others rubbed off. The three buds left upon the other cane, or head of the vine, are allowed to grow, and if the vine is a strong one, all the buds will produce fruit, as shown in the illustration.

The bearing canes on the arms are stopped at the usual height, while those on the main spur, or stem, are allowed to grow on above the others, in order to secure a good, strong, and long one to lay down for an arm the next season; but, unfortunately, this does not work well in practice, because the sap will flow into these upright canes growing directly over the main stem far more freely than into those on the arms, and this diversion of the sap usually occurs just at the time the fruit on the arm needs it most.

If all the upright bearing canes are stopped at the same height, the forces of the vine are evenly distributed, no one or more of the canes having an advantage; but this would simply reduce the system to one of permanent arm and spur, and there would be no reasonable excuse for renewing the arm annually or in alternate years, except to test the theory of old wood resisting the free flow of sap through it, as claimed by Professor Munson.

Reversing the Arms.—There is an old German plan of laying down the arms, which is quite the reverse of those we have shown. Instead of the right-hand cane being laid down to the right, it is bent over to the left, and the left one is bent to the right, as shown in Fig. 67, the object being to check the flow of sap, and cause the buds to break more evenly than if the canes were laid down without reversing them. It does have this effect upon the canes, and there is no particular objection to it, although the same results are secured when the arms are curved down in the manner shown in Fig. 42. It has been claimed, by those who advocate this mode of

FIG. 67.

forming the arms, that the check given the vine by thus bending it, continues after the first year; this, however, is very doubtful; because, in the growth of the vine, new cells are formed in the concentric layers of the wood, which allow a free passage of the sap through them, whether the vine is grown on a straight line or on a curved one.

German Bow System.—This system is usually referred to as the "German bow system," probably because it was first used in this country by some of the German vineyardists of Ohio, but it is as much French as German, although, as described in some of the French works on grape culture, two stakes are used instead of one, and the bow is brought down to an almost horizontal position, forming an elongated bow-like arm.

The vines are started the same as with other systems, until we have obtained two strong canes; then one is cut down to two or three buds, and the other to eight or twelve, according to the strength of the vine. Fig. 68 shows the new cane, as pruned. The longest

FIG. 68.

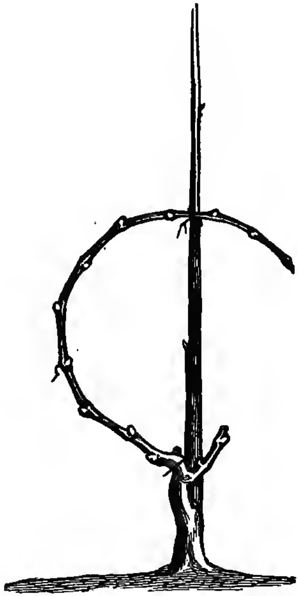

FIG. 69.

cane is then bent, and forms what is called the bow. Sometimes the end is brought around and tied to the stake, and at others it is only bent in a half circle and tied where it crosses the stake, as shown in Fig. 69. Two stakes are sometimes used, so as to better support the bow when it is covered with fruit and foliage. The fruit is mainly produced on the bow, and the young bearing shoots are stopped two or three leaves beyond the last bunch of fruit. The two buds left on the spur are allowed to grow and form canes, one of which is taken for the bow next season. The cane which forms the bow is cut away after it has borne one season. The cross line at its base shows where it is to be cut. Fig. 70 shows the vine as it appears with fruit. The same plan is pursued every year; one of the two canes is cut at a sufficient length to form the bow, and the other cut back to two or three buds. When the vine becomes old and strong, two bows are formed instead of one. The objections to this system are, that when trained on stakes the bearing shoots have no support, and they swing about, and the fruit is more or less damaged by rubbing against the leaves and vine; when trellises are substituted for stakes, this difficulty is removed. Still, the same objection remains which exists in the single arm system—that is, one portion of the vine is severely checked, while another is allowed to grow freely. The circulation of the sap in the bow becomes less rapid as

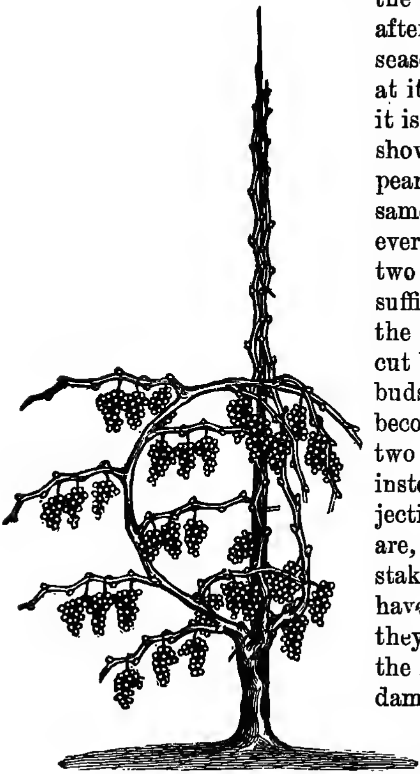

FIG. 70.

the upright canes advance, and the fruit upon it is only partially supplied with nutriment at the time when it is most needed. Where wine is the object, the bow system may answer very well, as the fruit is probably hastened in maturity by the severe check that is given to the flow of sap.

Fig. 71 shows a bow system, as given by Rubens. It is merely a multiplication of bows upon the same

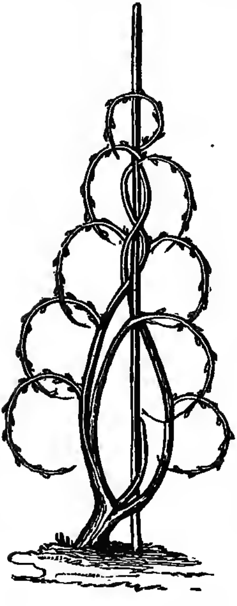

FIG. 71.

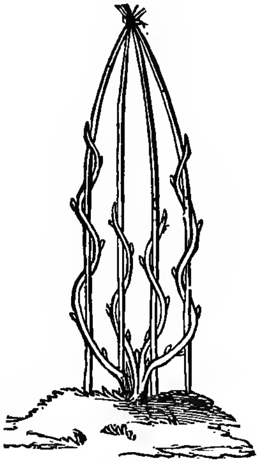

FIG. 72.

vine. Three or four canes are grown, two of which are left at considerable length, and by twisting them about the stake, shoots are produced which are bent down and form the bows. It is merely a fancy system, and shows what can be done with the vine; but it is really of no practical use.

Fig. 72 shows a system of serpentine training taken from Rubens' work. This plan is a very good one for garden culture, as the vines are trained to stakes and pruned low. The stakes are set eight inches to a foot apart, and the upper ends brought together and fastened, as shown. The vines are first grown with one cane, the next season two, and the next with four; but instead of cutting them down to the two buds, they are cut off at from two to four feet, and the cane twisted around the stakes; this checks the upward flow of sap, and causes all the buds to push on the whole length of the cane. The next season four more canes are selected from

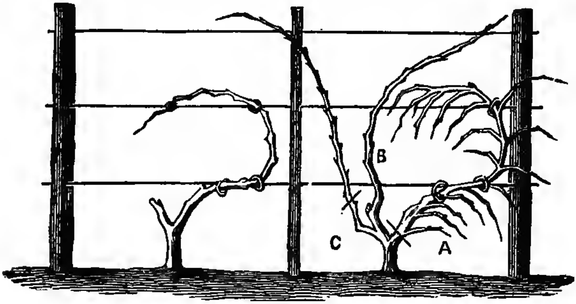

FIG. 73.

among the new ones (always choosing those that are strong and from near the ground), and the old canes are cut away above those selected. The new ones are shortened, and twisted around the stakes, as those of the previous season.

Husmann's Bow System.—Mr. Husmann, in his work, *Grapes and Wine,* advocates a bow system similar to the one we have shown in Fig. 71, but he trains the vines on trellises instead of stakes. This is certainly an improvement, because the vines can be kept more steady, and the fruit will not be so liable to injury by the wind. Fig. 73 shows two vines trained with a single bow, as recommended by Mr. Husmann. The vine on the left hand is shown as it appears when pruned in spring. The right-hand figure gives the same vine in the autumn after the leaves have fallen. *A* is the bearing cane, or bow, which is to be cut entirely away, at the point shown by the line crossing it near the base. The left-hand cane is cut off at *C*, and the cane *B* is shortened to ten or fifteen buds, and bent over to the right, to form the bow for the next season. This system is a very good one for the more rampant growers, particularly those which are naturally unproductive, or produce only small bunches. If the variety trained in this

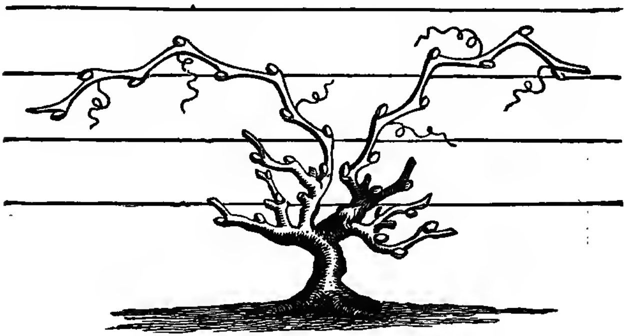

FIG. 74.

manner produces very large bunches, it must be evident that the young bearing canes will require considerable care; for, if not tied firmly to the trellis, they will be broken off by the wind. It is far from being a neat or systematic mode, but will answer, where wine-making is the object, and the appearance of the fruit not important.

The Fan System.—This is a very old and common mode of training vines on wire trellises, and, I may add, a most excellent one for the vineyard, and especially where labor is dear and grapes are cheap. It does not require any great amount of experience or skill in pruning, but the vineyardist and his assistants must know something of the nature of the plants, in order to determine how much or little bearing wood to leave at the time of the annual pruning. The young canes of the season should be spread out and tied to the trellis during the summer, somewhat in the form of the ribs in a fan, this affording a uniform exposure of the foliage to the sun and air. The laterals may be pinched back, or entirely removed, and the strongest canes checked by pinching, as in other systems, thereby equalizing and distributing the sap among the bearing canes.

At the time of pruning, the vineyardist can see, at a glance, how each cane should be cut, as they are all spread out before him, and not in a tangle, as they are

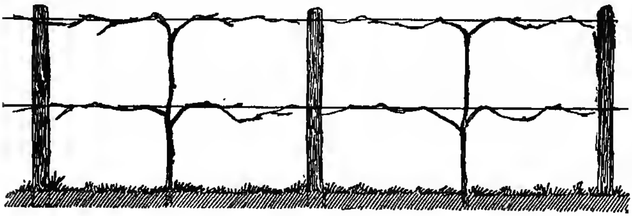

FIG. 75.

certain to be in some of the systems in vogue. He can prune long or short, according to the strength of the plant, or of the individual canes, and if the vines, at first, have been pruned too low, he can gradually change the form by leaving one or two of the central canes longer than the others, as shown in Fig. 74. This system is specially adapted to the smaller varieties, which are raised exclusively for wine-making, because it will enable the vineyardists to obtain a fair crop of fruit from some that are naturally unproductive.

The Kniffin System.—Of this system perhaps more has been said and written than any other, of late years, and it is claimed to be largely in use in the Hudson River grape-growing regions. The vines are planted and trained during the first two or three years as in all other of the well-known systems, but as they reach the two horizontal wires on the trellis an arm is laid down and trained to each, thus giving a two story and a four arm vine, as shown in Fig. 75. From these arms the young growth and bearing canes are allowed to hang down and ramble about at will, as shown in Fig. 76,

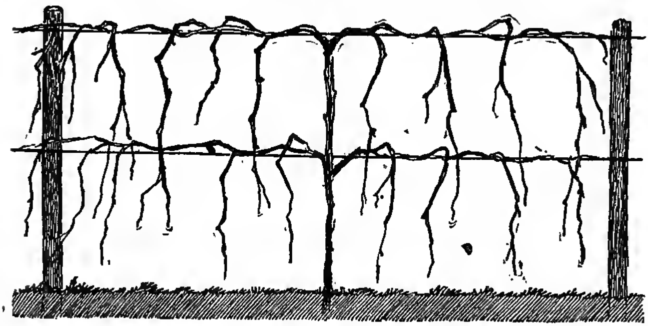

FIG. 76.

instead of being tied up, as advised in the spur and arm system. The lower wire is placed three and a half feet from the ground, and the top one five and a half or six feet. The annual pruning, when the vines become well established, consists in cutting back all the canes of the preceding season's growth, except those nearest the main stem, employing these for renewing the two or four arms; but these arms are to contain four or five buds each, according to their size and strength.

Summer pinching and rubbing out of superfluous buds is recommended, especially when large and fine bunches are desired for market. Upon the whole, this system is a kind of half-renewal, half-arm, or, to use a common phrase, a hit or miss mode of pruning and training, in which the vines are not subjected to any definite rule or form.

That good grapes in abundance are, and can be, produced on vines manipulated in this way, there is no doubt, but the same may be said of hundreds of other systems of training in vogue, all of which show that the grape vine responds nobly to fair treatment, and even to total neglect, as when growing in its native habitats.

CHAPTER XVIII.

MISCELLANEOUS.

Thinning the Fruit.—There are very few varieties of grapes, cultivated in the open air, that require the thinning out of the fruit to enable them to ripen. Most of the native varieties have bunches sufficiently open and loose to allow the air to circulate freely among the berries and aid them in ripening. If a portion of the berries are removed, those remaining will certainly grow much larger than if all were allowed to mature. There are some varieties that have naturally very compact bunches, so much so that all of the berries will seldom ripen unless a portion of them is removed. With such as these it is best to cut out a part of the berries so soon as they are fully formed. This thinning should be done with a pair of sharp-pointed scissors, cutting out from one-fourth to one-half the berries, taking them from different parts of the bunch, so that when it is fully grown it will be uniform, and the berries will not be any more crowded upon one part than another.

It would scarcely be practicable to thin out the berries of all the bunches in a vineyard, and no one would think of cultivating extensively a variety that required it; still, there are varieties which are highly recommended by some persons, that will seldom mature more than half the fruit that sets. The bunches of these should be thinned. These varieties often possess valuable qualities, and if persons have time to give them the requisite care, really excellent fruit may be obtained.

The compactness of the bunch is often variable with the same variety in different localities; in one the berries may be very much crowded, and in another comparatively loose. In the former case the berries will not only be much smaller, but they will often burst open, especially if they have a very thin skin.

Those varieties that produce very compact bunches are always benefited (in appearance, at least) by thinning the berries, and those who are growing such with the expectation of making show bunches, should not neglect this operation. Sometimes it may be beneficial to remove whole bunches, but when the vines are properly pruned and trained, this will seldom be necessary.

Bagging the Fruit.—Enclosing the growing bunches of grapes in thin manilla paper bags, as a preventive of mildew and black rot, as well as attacks of bees, wasps and other insects, has been largely practiced, of late years, with excellent results. Before applying the bag two or three small holes should be made in the bottom, to allow any water getting in at the top to drain out. The bags should be large enough to allow the full development of the fruit, and applied early in the season, or as soon as the berries are set on the bunch. The use of such a protection will seldom be required to prevent fungus diseases, in vineyards where spraying is practiced, but may be useful in saving the fruit from the attacks of bees and insects, especially where perfect and well developed table grapes are desired.

The first vineyardist to employ paper bags, in this country, as a protective appliance, and of whom I have any authentic account, was Mr. Alphonse Loubat, of Brooklyn, N. Y., who, early in the present century, had a vineyard of foreign grapes growing on land now covered with blocks of buildings in the said city. Mr. Loubat published a small work in French and English, under the title of the "Vinedressers' Guide," in 1827. Some thirty odd years later an old resident of Brooklyn, who had been a frequent visitor to Loubat's vineyard, informed me that paper bags were extensively employed to prevent mildew, and the owner of the vineyard seemed to be very proud of the discovery, that by such simple means very perfect fruit could be secured.

Gathering the Fruit.—Grapes are usually gathered long before they are *really* ripe. Sometimes this is done for the purpose of getting them into market early; in other cases it may be because they *appear* to be ripe, when, in fact, the ripening process has only commenced. Nearly all varieties change their color fifteen to twenty days before they are fully matured; and as the grape is one of those fruits that must ripen before being gathered, or not at all, it must be apparent that too much care is not likely to be given upon this point.

It is natural to be impatient for the harvest, particularly when we have waited so long, and watched with so much care and anxiety for the ripening of our fruit; still, a little haste may be more fatal than considerable delay; for grapes that are over-ripe keep much better than those that are not *fully* ripe. The stem of the bunch will usually turn brown and become somewhat shriveled when the fruit is fully matured.

Always gather the grapes in fair weather, and wait until the dew has dried off before commencing in the morning. Cut off the clusters with a knife or shears, and handle them with care, so that the bloom shall not be rubbed off nor any of the berries broken.

If any portion of the crop is not ripe, leave it on the vines and gather it separately, after the best has been secured, provided it is worth the trouble. If there be any unripe or diseased berries in the bunch they should be taken out at the time of gathering.

Preserving the Fruit.—To many persons the preservation of fruit in its natural condition is second only in importance to that of producing it. If we can, by any simple means, keep our grapes fresh two or three months, it not only prolongs the period of enjoyment of a luxury, but, if it be desired to sell the fruit, the price will be found to increase as the season advances, beyond the usual marketing period, the earliest and latest in market always commanding the highest prices, although not always the most ready sale.

There is no reason why the tables of those who desire grapes should not be supplied with them for four or five months in the year. Every variety of grapes will not keep well, any more than every sort of apples or pears; still, a majority of the grapes now grown will keep several months, with ordinary care.

The process of preserving is very simple, and requires more common sense than science. The requisites are: 1st, The fruit should be thoroughly ripe, should not be bruised or broken, but carefully handled while gathering and packing. The fruit may be put away on shelves, or packed in small boxes; the latter method is probably the best, as it is more liable to become shriveled when left in an open room than when confined in a smaller space. Boxes that will hold from twenty to thirty pounds are of convenient size, and the fruit will retain its flavor much better with twenty pounds in a box than when there are only five pounds. The boxes should be made so that they can be shut tight; if there should be need of ventilation, it can be given by opening the box, but constant ventilation of them is only another name for continual evaporation, which would cause the fruit to shrivel, and thus destroy its value.

A cool and steady temperature should be maintained, and if it could be kept between 35° and 40° there would be but very little trouble in keeping the fruit, even if but little care were given to the packing. Very few persons have a room or cellar that can be kept so cool as 40°; consequently more care is necessary in gathering, packing, etc.

A warm, *damp* atmosphere is very injurious, as it will soon cause the grapes to rot; but the presence of considerable moisture will do no harm, provided the temperature is low; but, unfortunately, very few persons, except fruit growers who have erected cold storage rooms or cellars expressly for such purposes, have any place but a common cellar in which to keep their grapes, and, as a result, they soon wither and are worthless. Our native grapes, as a whole, are not good keepers; their porous skin, a little thin juice, and much tough pulp around the seeds, is not the best form of fruit to be preserved for any considerable time after gathering, but with what is called cold storage, or where the temperature can be kept down to near the freezing point, some of the tough skin varieties may be preserved in fair condition for two or three months, but rarely longer. The more meaty fleshed foreign varieties, like the Malaga grape, is sent to this country in immense quantities; although very inferior in quality, it is of large size, and has a hard, plum-like flesh, which will resist rough handling and remain sound and firm for months in cool weather. The more delicate the fruit, the less valuable for keeping or sending long distances to market; and this is not only true with grapes, but with nearly all the larger fruits and many vegetables.

Sawdust is often used in packing the Malaga grapes which are so common in our markets; but the flavor of the grapes is always injured more or less by it, giving them a strong, woody taste. Cork-dust is far better than common sawdust; but it cannot be obtained, except near cork manufactories, and perhaps not then to any amount. If any such material is to be used, there is none better or more easily procured than chaff of rye, wheat or oats. Rice chaff would probably be still better.

When the grapes are gathered, bring them into a cool room and spread them out upon a table or shelves, and let them remain there for a few days, until all surplus moisture has passed off; then pack them away in the boxes, as follows: Spread a thick sheet of paper on the bottom, then lay on a layer of bunches, placing them close together; then another sheet of paper, and so on until the box is full. Boxes deep enough to hold four or five layers are better than deeper ones. When the boxes are filled, put them away in a cool place, and where they can be examined occasionally, and the decayed berries be taken out from time to time as they appear. If the place is cool and the fruit sound and ripe, they will keep three or four months without further care. But if the grapes are to be marketed within a few days, then they may be immediately packed into the common five and ten pound "free fruit" baskets, and the bunches laid in as close and as snugly as possible. If the vineyardist has a cold storage room in which to place the baskets as they are packed, they may be kept a week or two before shipping, but it is not well to send off baskets packed for any considerable time without careful inspection, because those who sell such fruits on commission dislike to receive complaints from their customers about bad packing and poor condition of the articles passing through their hands. It is rare that an inferior article of any kind commands remunerative prices in any market, and vineyardists have to be constantly on the alert to prevent loss from bad packing and rough handling of their grapes.

Wine Making.—For my own part, I could never understand why wine making had anything more to do with grape culture than whisky or starch making had to do with corn growing, or cider making and the production of apple jack should necessarily be recognized as a part of pomology. Two hundred years ago, when John Evelyn wrote his "Pomona," it would not have been thought complete without those wonderful chapters on "The Making and Ordering of Cyder!" The man who writes a book on apple and pear culture, at the present time, would hardly think it in his line to tell how to make perry and cider, nor would it be expected of him. I shall therefore depart from the general rule, and for two reasons: 1st. I believe that wine and brandy making do not necessarily belong to grape culture. 2. I should not be able to give any information from actual experience; and I believe the reader will agree with me that in horticulture, at least, none have a right to become teachers until they have, themselves, been scholars.

There are plenty of men in our country who know how to make wine, and from them we should get correct information upon the subject, provided they can be persuaded to give it, and none others should be heeded. It is not every one who attempts to make wine, that accomplishes it; for every vineyardist does not know how to make wine, any more than every wine maker knows how to grow grapes.

My main object, in writing this book, was to aid those who might desire to raise grapes for home use or market, and at that time,—now thirty years since,—good table grapes were very scarce everywhere in this country, and very few persons who planted vines in their gardens, or elsewhere, had any clear ideas of how they should be pruned or trained; and very much of this ignorance still remains, even with the immense amount of information published on the subject during the past two or three decades. But professional vineyardists have increased in numbers immensely during these years, and their labors have, upon the whole, been crowned with success, and we need no better proof of it than the abundance of excellent grapes to be seen every autumn in the markets of all cities and villages, from the Atlantic to the Pacific oceans. Good dessert grapes have, of late years, become so cheap and plentiful, that even the poor of our great cities may now freely indulge in fruits

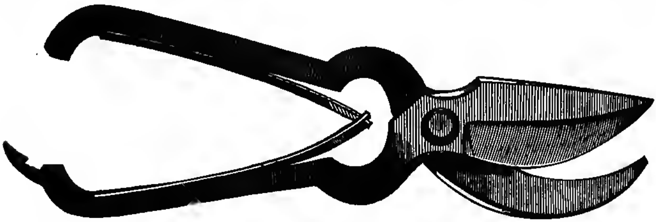

FIG. 77.

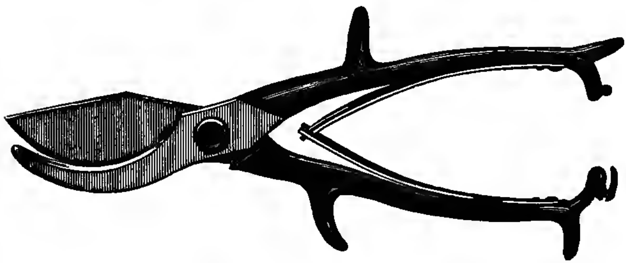

FIG. 78.

which a few years since was only to be obtained as luxuries, and by the rich and well-to-do people.

Whenever and wherever there is a surplus of good table grapes, the wine, vinegar and brandy maker may come in and help to dispose of it; but the production of such liquids and liquors is not, necessarily, an adjunct of grape culture.

Implements for the Vineyard.—The implements required in the vineyard are in no way different from those employed by gardeners generally, such as plows, hoes, spades and spading forks, and most essential of all is a good, sharp pruning, or pocket knife and pruning shears.

Those who have a large number of vines to prune know the importance of having a good implement with which to do it. With a first-rate pair of shears a man can prune many more vines in a day than he can with a knife; besides, there is less danger of breaking off those buds which it is desirable to retain. In pruning fruit trees the pruning knife is preferable, because we usually wish to make a smooth cut, so that the wound will heal over; not so with the vine, as the cut is generally made between the buds, and the wound is not expected to heal; the stump above the bud dies back to it, and if this is cut away it is only for looks—nothing more. Therefore, in pruning vines it is not requisite to leave a very smooth surface to the wounds, though to have an instrument that will cut smooth and easy is very desirable.

There are any number of styles of pruning shears—German, French, English and American. Some are good, but more that are good for nothing. But every vineyardist will usually have his personal preference in such matters, but the two forms of pruning shears shown in Figs. 77 and 78 are both of American manufacture, and have long been in common use.

CHAPTER XIX.

INSECT ENEMIES OF THE GRAPE.

In its natural wild state the grape appears to be about as free from insect enemies as any other fruit-bearing plant; but it has a few, and these have been allowed to increase upon vines under cultivation, until they are becoming quite formidable, and in some parts of the country their ravages have been so great, of late years, as to materially lessen the product of many vineyards.

The rapid increase of noxious insects is, without doubt, owing, in a great measure, to the destruction of those birds that live mostly upon them. If we destroy or drive away the natural enemies of the insects, then we must take upon ourselves the office of destroyer, and work with perseverance and vigilance, or see all our efforts to produce fruit in abundance of no avail. That noxious insects are rapidly increasing throughout the country must be apparent to every one who has given the subject attention. Insects that, a few years since, were unknown in the Western States, are now found there in abundance, having been introduced, not only from the Eastern States, but imported from European countries with seeds, fruits, etc.

It matters but little where these hosts of insects come from, the fact that they exist, with few idlers among them, is enough to set every one of us to work to check their progress in every way possible. To proceed on our work of destruction understandingly, we should first know our enemies; for some insects that are found on the grape vine do not injure it, like the common Lady

Beetle, but assist us in destroying those that are injurious; therefore, an indiscriminate slaughter, in many cases, would be very injudicious. There are many nostrums offered, at the present time, which are said to be insect remedies, and, doubtless, a few of them are really what they purport to be, as some are easily destroyed by very simple means, but there is no universal remedy, the application of which is at all practicable. A material that would act as a poison upon one might serve as a food for another, while it would be very difficult to find anything so powerful that it would kill all kinds of insects, and, at the same time, not injure the plants upon which they were found.

It should also be borne in mind that all the different orders and families of insects are not constructed exactly on the same plan, and do not obtain their food nor attack plants in the same way. For instance, the beetles (*Coleoptera*) have mandibles, or jaws, with which they bite, crush, or, as it may be said, chew their food; and when these pests attack plants they cut holes in, or consume the leaves and stems, and their grubs (larvæ) do the same; consequently, by dusting or spraying the plants with poisons, such as Paris Green, London Purple, or even less virulent insecticides, a few particles taken in with their food causes death. With the *Lepidoptera,* butterflies and moths, no solid food is consumed by the perfect winged insect, although they may sip a small amount of liquids occasionally; but when in the caterpillar stage they are usually very voracious, having strong mandibles, like the larger beetles, or *Coleoptera,* and may be destroyed with similar preparations or poisons; but many of the species are so large that they are readily gathered by hand.

The *Hemiptera,* or true bugs, are not furnished with strong mandibles, or jaws, but in place of these they have a proboscis-like organ, with which they puncture the succulent parts of the plant and suck its juices, causing it to wither and die. We cannot poison these insects by scattering or spraying mineral or other poisonous substances over the foliage and stems of the plants, simply because the bugs do not eat either leaves or stems; but we can kill them by applying thin liquids, gases, or the fumes of various substances direct to their bodies, thereby causing suffocation. Among the most pernicious pests of this order which attack the vine are the aphides, or plant lice, widely known as aphis, which attack and suck the juices of the young leaves and shoots in spring and summer. In the same order we have the thrips, the mealy-bug, cottony-scale, and various other kinds of sap-sucking bugs.

Among the *Hymenoptera*, such as bees, wasps, saw-flies and ants, there are comparatively few that are injurious to the vines, although the wasps and honey bees often destroy an immense quantity of fruit, and the sweeter and better the grape the more likely they are to be attacked by bees and wasps.

I am well aware of the fact that to accuse the honey bee of destroying grapes is treading upon dangerous ground, for apiarians insist that the bees are never the first transgressors, but only follow the wasps, who cut the skin of the berries and let in the "busy bee" to enjoy the feast; but I fail to see why the bees should be held innocent of robbing, simply because some other insect has opened the door to a valuable repository. Neither will this exonerate the owners of bees; for in neighborhoods where a number or many hives are kept, they do sometimes destroy more fruit in a week than the wasps do in the entire season. The claim made, by bee-keepers, that the honey bee cannot puncture or make a hole in the skin of grapes and other fruits with their mouth parts, which are so well developed for gathering the sweets of plants, and which are strong enough to uncap honey cells sealed with dry, hard wax, is scarcely tenable; and even if their mandibles were not strong enough to puncture a thin-skinned grape, their front feet, or *tarsi* are, and these insects are certainly wise enough to use the implements with which nature has provided them for securing food. The truth of the matter, it seems to me, is that the domesticated honey bee is an insect of peculiar moods and tastes, and while we may not be able to account for certain erratic and seemingly inconsistent acts, still it is well known that they will attack fruits with an almost insatiable voracity, and perhaps the very next season could not be induced to touch it. Having been a beekeeper for a number of years, with neighbors who keep a large number of hives, I have not been without abundant opportunities for observing the habits of these valuable and, in the main, very useful insects, but there is no denying the fact that they will sometimes get into moods which are far from being agreeable or harmless to their owners and others.

In the following list of noxious insects infesting vineyards I shall only attempt to name a few of the most common and best known. But every vineyardist should make himself acquainted with the various insects infesting the vine, and thereby be enabled to more successfully check their ravages.

There are now many excellent works published on economic entomology, and all within the reach of those who may desire information on this subject. In addition to, at least, a half dozen standard practical works on entomology which have been published within the past few years, there are several excellent periodicals devoted to the same, besides the annual reports of a number of State Entomologists, and those of the Division of Entomology of the U. S Department of Agriculture. There have also been published and distributed many special entomological bulletins and monographs, by the various State Experiment Stations. All of these sources of information on entomological subjects have, with one or two exceptions, been introduced and established since the first edition of this work appeared, hence the less need of an elaborate dissertation on the insect pests of the grape.

Rose Chafer, or Rose Beetle (*Macrodactylus subspinosus*).—This beetle measures seven-twentieths of an inch in length. Its body is slender, tapers before and behind, and is entirely covered with very short and close ashen-yellow down; the thorax is long and narrow, angularly widened in the middle of each side; the legs are slender, and of a pale red color; the joints of the feet are tipped with black, and very long. This is one of the most common and destructive insects known to infest the grape in this country. In some seasons it makes its appearance in such vast numbers that it is impossible to stay its ravages. It does not seem to be at all fastidious in regard to its food, as it feeds indiscriminately upon nearly all kinds of plants. It prefers, however, the flowers of plants to their leaves, and it usually makes its appearance in the spring, about the time the grape comes into bloom. It eats the flower with avidity, and when it appears in large numbers they make short work of the entire crop.

There are a number of remedies recommended for the Rose Chafer, but I know of none better or more effectual than that of catching them by hand and killing them. They can be caught very rapidly by taking a large cup, or basin, with a little water in it, and a teaspoonful of kerosene, and holding it under the insect; giving the cluster of flowers a slight jar, the beetles will immediately let go their hold and fall into the dish. When a quantity have been caught, throw them into the fire or pour hot water upon them. I have followed this simple plan for several years, and though I have not been able to annihilate them, their numbers have not increased.

If a whole neighborhood would band together, each destroying all to be found upon his own place, there would be a prospect of soon exterminating this most destructive enemy of the grape. There is no other way of destroying them than to attack the insect itself, because the female deposits its eggs in the ground, where they cannot be reached by any ordinary means.

To collect the beetles from the flowers of the grape is often rather difficult, and the better way is to employ decoy plants, and entice them away from the vines. For this purpose I have made use of several species of the *Spiræa*, but the best two for this purpose are the sorbus-leaved (*S. sorbifolia*) and the Goat's Beard (*S. Aruncus*). Both of these species bloom in spring with the grapes, and continue in flower for several weeks. The first is a vigorous-growing, hardy shrub from Siberia, producing numerous long upright spikes of white flowers, which are special favorites of the rose beetle, and if around they are sure to be found on this plant, feeding upon its flowers, from which they can be readily shaken into any vessel used in collecting such pests.

The Goat's Beard spiræa is a hardy, indigenous herbaceous plant, forming large clumps, which may be divided for the purpose of propagation. The flower stems grow three to five feet high, and the flowers are of a tawny white color and produced in many slender spikes, disposed in a long compound panicle. When the rose beetles gather on these flowers we have only to bend over the spikes and shake the pests into the collecting pan. These plants are abundant and cheap, and I have used them as decoys for the rose beetles for many years with excellent results.

Blue Flea Beetle (*Graptodera chalybea*). This is a very small jumping beetle, usually of a steel blue or greenish blue color above; the underside is a dark green, and the antennæ and feet are dull black. It is only about three-twentieths of an inch in length, but when abundant it soon cuts the leaves full of holes and does considerable damage.

Usually two broods appear in a season; the first in April or May, according to latitude, and the second in July and August. Dusting the vines with soot, or strong hard wood ashes will usually drive them away, if it does not kill them. Arsenical poisons may also be applied, if more simple insecticides do not answer.

FIG. 79.

Spotted Pelidnota (*Pelidnota punctata*). This beetle is occasionally found upon the grape vine in the months of July and August. "It is of an oblong, oval shape, and about an inch long. The wing-covers are tile-colored, or dull, brownish yellow, with three distinct black dots on each, Fig. 79; the thorax is darker and slightly bronzed, with a black dot on each side; the body beneath and the legs are of a deep, bronzed, green color. The *Pelidnota* is of such a large size that, should its numbers ever become great, it would be very destructive. I have never found more than half a dozen upon any one vine, and these were easily picked off and killed.

FIG. 80.

Goldsmith Beetle (*Cotalpa lanigera*). — This beetle is found mostly upon trees, such as the pear, oak, hickory, but most abundant on the poplars; but having, in several instances, found it feeding upon the leaves of the grapevine, I have inserted an illustration (Fig. 80) and a description, so that the attention of the vineyardist might be called to it in case its numbers should become so great as to render its destruction necessary. It is about nine-tenths of an inch in length, broad, oval in shape, of a lemon color above, glittering like burnished gold on the top of the head and thorax; the under side of the body is copper colored, and thickly covered with whitish wool; and the legs are brownish yellow, or brassy, shaded with green. They appear in this vicinity in June. There are also four other native species of the *Cotalpas*, but all inhabit the far Western States except the one described.

Grapevine Fidia (*Fidia viticida*).—This is a small chestnut-brown beetle covered with a grayish pubescence. It is about three-eighths of an inch in length, with a narrow thorax and small head; but when abundant it will soon cut vine leaves into shreds, and seriously check the growth of the plants. This insect has the habit of dropping to the ground when disturbed; consequently not easily caught, except by chickens, who seem to be very fond of them, and for this reason fowls should be allowed to have the run of vineyards where these pests occur. These beetles may, however, be poisoned by dusting the leaves with arsenical insecticides, or with Persian insect powder.

The Grape Curculio, or Weevil (*Craponius inæqualis*).—This is an indigenous pest which has probably bred in the wild grapes for many ages past, and now occasionally attacks the cultivated varieties. My first acquaintance with it began in 1869, when a correspondent residing in Canada sent me a number of infested berries, but later I learned that it was quite abundant in Ohio, Illinois, and several other Western States. It is a minute little pest, scarcely more than one-eighth of an inch long; of a black color with a grayish tint, and it is about as broad as long. The females deposit their eggs on the young berries during June and July, in our

Northern States, and the young grubs feed upon the pulp, causing the grapes to turn brown, as though struck with disease. The grubs are of a whitish color, and about one-fourth of an inch long when fully grown. These grubs leave the fruit the last of July and bury themselves in the ground, here changing to pupæ within a small, smooth, earthy cell, and in September the beetles issue and probably hibernate in this stage during the following winter months. I am unable to suggest any better way to destroy these pests than to gather and burn the infested fruit.

Grape-cane Curculio (*Ampeloglypter Sesostris*).—This is even smaller than the grape weevil, with a longer snout and a much narrower body; the prothorax of a brown color, and elytra (wing covers) black and slightly punctured. This little pest does not attack the berries, but it does the young, tender shoots and canes, causing galls upon them, the larvæ, or grubs, living within these swellings. The remedy is to cut off the gall-bearing canes and burn them as soon as discovered. There are a large number of insects which infest both the wild and cultivated grape, producing galls on either the leaves or growing canes, but the remedy is the same for all, *i. e.*, gather and burn the galls before mature or the insects have escaped.

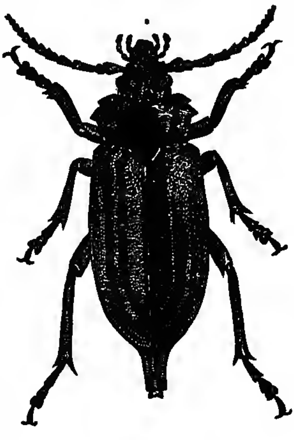

FIG. 81.

Grape-root Borer (*Prionus laticollis*).—There are, at least, a half dozen species of the *Prionidæ*, the larvæ of which are occasionally found boring in the roots and stems of large and old grapevines. In the Eastern and Middle States the Broad-necked Prionus (*P. laticollis*) is the most abundant, while in the Western the Tile-horned Prionus (*P. imbricornis*) is the most frequently reported as attacking vines. In California, and eastward to New Mexico, the *Prionus Californicus* is most plentiful. These beetles are all large, and a female of average size of the Broad-necked Prionus is shown in Fig. 81. Their larvæ are also large, varying from two to three inches in length, and some times fully a half inch in diameter. They are really giants among the borers, but fortunately they prefer forest trees and shrubs to grapevines, and only occasionally breed in the latter. The only remedy is to destroy the beetles; for the vine usually dies before the presence of the borer is discovered.

FIG. 82.

Caterpillars. — Caterpillars are the larvæ of butterflies or moths. These insects have four stages of existence: The egg, caterpillar, pupa, or chrysalis, and the perfect insect. Of these it is the caterpillar alone which is troublesome; they feed upon the leaves of plants and are often very destructive, especially in city gardens. In certain groups the caterpillar becomes, in its winged state, a butterfly, and in others a moth. The former fly by day, and the latter mostly by night, or toward evening only. They are also distinguished by peculiarities of structure not necessary to mention here. The numerous species are recognized by the entomologist by their form, color, structure of legs and antennæ, and numerous other characteristics which enable him to classify them into genera and families.

The Grapevine Plume (*Pterophorus periscelidactylus*, Fitch).—Although this is one of the smallest of the moths infesting the grape, it is, at the same time, one of the most troublesome and destructive. Just about the time the bearing canes of the vine begin to show embryo flower clusters, the leaves around these are found drawn together and fastened with fine silken threads, and upon opening these folded leaves will be found one or two small, greenish-white hairy caterpillars, as at *a*, Fig. 82, and *d*, the little moth. These caterpillars, if undisturbed, soon destroy the embryo clusters of flowers and prevent the production of fruit. These pests are so securely enclosed within the folded leaves that they cannot be reached with ordinary insecticides, and the only way of destroying them is to examine the vines daily and pick out the caterpillars by hand. This grapevine plume remains for only a very short time in spring, the caterpillars soon leaving the vines; but while they are on it they can do a great amount of damage, but no more than the following:

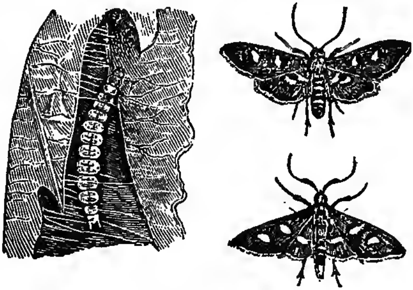

FIG. 83.

The Grape-leaf Folder (*Desmia maculalis*).—In Fig. 83 a male and female moth, with one of the caterpillars half enclosed in a folded leaf, is shown, all three copied from the "*American Entomologist*," Vol. II, 1869. Dr. Riley, in describing this insect, says that the moth is a very pretty thing, expanding, on an average, almost an inch, with length of body about one third of an inch. The color is black, with an opalescent reflection, and the under surface differs only from the upper in being less bright; all the wings are bordered with white. The front wings of both sexes are each furnished with two white spots, but while in the male there is but one large spot on the hind wings, in the female this spot is invariably more or less constricted in the middle, especially above, and is often entirely divided into two distinct spots, as shown in the right-hand, or female moth in Fig. 83. These moths, when disturbed, are very active, and soon wriggle out of the leaf and drop to the ground. Crushing with finger and thumb is the only way I have ever found to destroy them, and although I have fought these pests for years, they are still very plentiful in my grounds.

The Yellow Bear (*Spilosoma Virginica*).—This is also known as the salt marsh caterpillar, because it breeds in the salt marshes; and towards autumn, when nearly full grown, it migrates to the uplands, invading

FIG. 84.

gardens and vineyards, overrunning and stripping the vines of their leaves. It is only near the seacoast that these caterpillars are very numerous and destructive. The moth is white, with a small discal dot on the fore wings, and two black dots on the hind wings, one on the middle and another near the inner angle. The caterpillar, when full grown, is about two inches long, and covered with long yellowish hair, Fig. 84, hence one of its common names. Hand picking is the best and surest way of getting rid of this pest, and as they are so large they are not at all difficult to collect while feeding.

Sphingidæ, or Sphinx Moths.—Among the sphinges we have some of the most voracious of all the caterpillars. They are literally gluttons, as they never seem to stop eating from the time they are hatched until they pass into the chrysalis state. They are very de-

FIG. 85.

structive in a nursery of young vines, as a single caterpillar, when nearly grown, will, in twenty-four hours, eat every leaf on a one-stem vine of three or four feet high. The name *philampelus* (lover of the vine) is very appropriate, and was given to one group of these moths by the late Dr. Harris. There is a large number of native species, all with similar habits. They may be poisoned by dusting the leaves with insecticides, but the better way is to pick them from the plants and crush them with the foot, or otherwise. The following are some of the most common and destructive of these *Sphingidæ*.

The Satellite Sphinx (*Philampelus Satellitia*, Linn).—The moth is of the size shown in Fig. 85, and

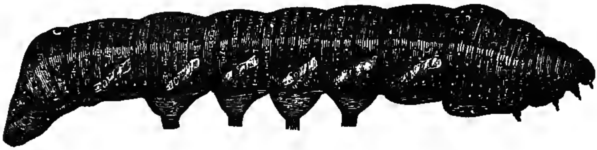

FIG. 86.

is of a light olive gray, variegated with dark olive green. The smooth, naked caterpillars, when first hatched, are of a green color, with a tinge of pink along the sides, with a long, straight pink horn at the tail. This horn soon begins to shorten, and by the third moult it entirely disappears, leaving only a small, eye-like spot on the last segment of the body. The color of these caterpillars is somewhat variable, but usually greenish or velvety brown, with lighter markings along the sides, as shown in Fig. 86. When these caterpillars have attained their full size and are about to transform, they descend to the ground and into it a few inches, where they shed their skin and change to a chrysalis of a deep chestnut brown color, and of the form shown in Fig. 87. These chrysalides are often plowed up while working in the vineyard late in fall or early spring.

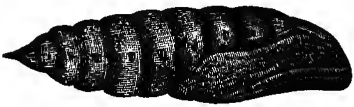

FIG. 87.

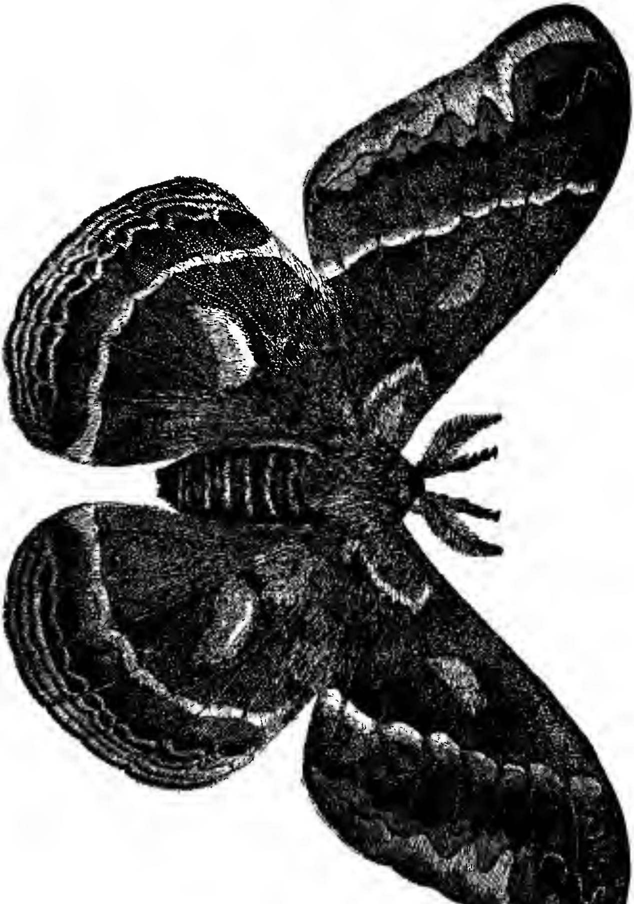

FIG. 88.

There are several other species of these sphinges which are occasionally found on the vines; among the most common I may name the Hog caterpillar (*Chærocompa pampinatrix*), and the Achemon Sphinx (*Philampelus achemon*), and the Abbot Sphinx (*Thyreus Abbotii*); the latter, however, attacks the Virginia Creeper (*Ampelopsis quinquefolia*), in preference to the cultivated grape. All the caterpillars of the sphinx-moths are so large that they are readily seen by the time they begin to do much damage to the leaves, and should then be picked off and killed.

FIG. 89.

The Cecropia Moth (*Platysamia Cecropia*).—This is our largest native moth, the larvæ of which feeds on the grapevine; but, fortunately, it prefers the currant, gooseberry and other shrubs, to the grape, but attacks the latter when more agreeable food is not abundant. These moths have a spread of wing from five to six inches, Fig. 88, and their general color is of a dusky brown, with hinder margins clay-colored; near the middle of each of the wings there is an opaque, kidney-shaped dull red spot, having a white center and a narrow black edging; and beyond the spot a wavy, dull red band, bordered internally with white; the fore wings, next to the shoulders, are dull red, with a curved white band; and near the tips of the same is an eye-like black spot, within a bluish-white crescent. The caterpillar, when young, is of a deep yellow color, with rows of minute black warts on its back. When it comes to full size, late in summer, it measures three inches or more in length, and is then of a light green color. The two warts on the second and third rings are of a coral red color, the others yellow, beset with black bristles. When the caterpillars leave the plants uponwhich they have been feeding they do not descend to the ground, like those of the sphinx moths, but retire to some secluded cane of the vine, or nearby shrub, and there spin a cocoon, fastened longitudinally to it, as shown in Fig. 89. When the leaves have fallen from the plants in autumn these large cocoons become quite conspicuous and may be readily gathered and burned, or otherwise destroyed.

BLUE CATERPILLARS OF THE VINE.

There are three or four different species of caterpillars infesting grapevines known under this general name, which have a close resemblance to each other, and are rather difficult to distinguish, except by entomologists, who have studied them very carefully. The parent moths, however, are very different; but these, unfortunately, are seldom seen by the practical vineyardist, whose interest in such matters is not usually awakened until he finds the caterpillars stripping the leaves from his vines. The largest of the blue caterpillars is the larvæ of

FIG. 90.

The Beautiful Wood Nymph (*Eudryas grata Fabr*).—This species is more or less common in all parts of the country, and, although called "wood nymph," it often attacks vines growing in city gardens. The moth is of the size shown in Fig. 90; the color of the markings on the fore wings are rusty brown and olive green; the hind wings nankeen yellow, broadly marked with pale brown on the hind border. The caterpillars are about an inch and a half long when fully grown, and of a bluish color, transversely banded with deep orange across the middle of each ring, the band being dotted with black, with head and feet orange; the top of the eleventh ring somewhat bulging, and the fore part of the body hunched up when the caterpillar is at rest. The caterpillars begin to appear about the middle of July, and others are hatched afterwards, and as late as the middle of August. They eat all parts of the leaves, even to the midrib and stalks. When not eating they generally rest upon the underside of the leaves, stretched out as shown in Fig. 91.

FIG. 91.

A closely allied species to the last is known as the Pearl Wood Nymph (*Eudryas unio*, Hubner). The caterpillars of the two species are almost identical, while the moths are quite distinct; for in the latter the brown markings on the wings are neither as large nor as dark in color, while the inner edge of the border of the front wings is wavy, instead of a smooth curved line. Both species of moths rest during the day on the under side of the leaves of the plants upon which they feed, and are only active during the early evening and night. Another species of these blue caterpillars belonging to the same family, but to a different genus, is the larvæ of The Eight Spotted Forester (*Alypia octomaculata*, Fabr). The moths are about the same size of the *E. grata*, but the wings are black, with eight spots, two on each wing; those on the fore wings being yellowish, those on the hind wings white.

FIG. 92.

The American Procris (*Procris Americana*, Boisd).—This is a small moth of a blue-black color, with a saffron-colored collar and a notched tuft on the extremity of the body. The wings, which are very narrow, expand nearly one inch, Fig. 92. The caterpillars are gregarious; that is, considerable numbers of them live and feed together, collected side by side on the same leaf, and only dispersed when they are about to make their cocoons. They are of a yellow color, with a transverse row of black, velvety tufts on each ring, and a few conspicuous hairs on each extremity of the body. They are hatched from eggs which are laid in clusters of twenty or more together, on the lower sides of the leaves of the grapevine and Virginia creeper; and they come to their growth from the middle to the end of August. They then measure six-tenths, or rather more than one-half of an inch in length. Their feet are sixteen in number and rather short, and their motions are sluggish. When touched they curl their bodies sidewise and fall to the ground; or, more rarely, hang suspended from the leaves by a silken thread. When young, they eat only portions of the surface of the leaf; but as they grow older they devour all but the stalk and principal veins, and passing from leaf to leaf thus strip whole branches of their foliage.

This pest is more numerous in the Middle, than in the extreme Northern States, and I have always found it more abundant on vines growing in city yards than in vineyards. As the caterpillar feeds entirely upon the upper surface of the leaves, it can be readily destroyed by dusting the leaves with lime, when wet with dew, or the leaves may be cut off with the insects upon them and thrown into the fire.

Thrips, Aphis and Vine Scales.—These are all minute insects, and live by sucking the juice, or sap, from the leaves, succulent shoots and half-mature canes.

The insect commonly known as Thrip, or Leaf-hopper (*Erythroneura vitis*), is a very active little pest, jumping many times its own length when disturbed. It usually congregates in large numbers on the under side of the leaves, puncturing and sucking the sap. They may be destroyed by dusting the under side of the leaves with Persian insect powder, or spraying with kerosene emulsion. The common green fly, or aphis, is a well known pest, readily destroyed by fumigating the plants with tobacco, or drenching them with strong tobacco water. Kerosene emulsion may also be used for the same purpose, but whatever insecticide is employed, repeated application will be required to keep any and all species of the *aphidæ* in subjection.

The larvæ of a small spotted insect called the Lady Bird, or Lady Bug, feeds upon the aphis, devouring vast numbers of them. The Lady Bird is the gardeners' friend, and they should never be killed if it can be avoided. These little beetles are usually red or orange yellow, with small black spots; some kinds have only two spots, others have as many as nine. They are very common, and many has been the crime that has been laid to them, of which they were entirely innocent.

The Red Spider (*Tetranychus telarius*) is one of the smallest insects that infest the vine. It is so very minute that it appears as only a small red speck, and can scarcely be seen by the naked eye. It usually confines itself to the under side of the leaf of vines in the house, though it will sometimes make its appearance on vines in small gardens and do considerable damage, especially during long and severe drouths.

They spin a fine web over the under surface of the leaf as a kind of nest, or protection; here they live in large numbers, and by puncturing the leaves for food, cause it to turn to a sickly yellow color. The upper surface will show small light-colored spots soon after the spider commences its attacks on the under side.

A continued warm and moist atmosphere is death to the red spider; but while we are destroying them, the aphis would be enjoying a most congenial atmosphere, consequently we must resort to other means than mere atmospheric changes to destroy any of these pests. Sulphur is the best remedy with which I am acquainted, and the one upon which gardeners mainly depend. It may be dusted over the plants, or be scattered on the soil beneath them. When used in the house, the usual method is to place it on the return flue, or pipes, being careful not to place the sulphur where it will become so hot as to take fire, for in that case the fumes will destroy the plants as well as spiders. There is but little danger of its taking fire if placed on the return flue, as the heat will usually be just sufficient to slowly melt the sulphur, and cause it to give off its fumes slowly.

Sometimes the sulphur is mixed with soft soap and water, and a little clay added to make the composition of the consistency of thick paint; this is then applied to the pipes and flues, when the sulphur is slowly evaporated and continues giving off its fumes for a long time. The constant fume of sulphur is not needed in a house; besides, it is very disagreeable.

The Vine Scale is occasionally met, but it is not common. To the unassisted eye it appears to be nothing more than a small scale, without the least appearance of life. The scale is the shell, or covering, of a very minute insect that pierces the bark of the young shoots and sucks its juices. Kerosene emulsion will destroy these pests, or a strong solution of potash—say one pound to four or five gallons of water—or an application of pure soft soap.

It is well to wash the stems of all vines in gardens with potash water every winter, as it will destroy insects that make their nests in the crevices of the bark. That portion of the solution that falls upon the ground is not wasted, because it furnishes the vine with potash, which is one of the most valuable ingredients of all manures.

There are various species of scale pests which may occasionally appear upon stunted and neglected vines, but they rarely attack those given good cultivation. Vines grown under glass, either for fruiting or propagation, are sometimes infested with what is called the Mealy-bug (*Dactylopius adonidum*), but this and kindred species are readily destroyed by spraying the plants with kerosene emulsion. The original formula for making the emulsion is, "kerosene, two gallons; common yellow bar soap, one-half pound; water, one gallon." Shave up the soap and throw it into the water, and place over a fire to heat, and when the soap is all dissolved pour into a larger vessel, and add the kerosene to the hot soap suds. Immediately churn the mixture by means of a force pump, or large hand syringe, for five or ten minutes. The emulsion, as churned, forms a thin cream, which thickens on cooling. Dilute before applying to the plants, with cold water, one gallon of the emulsion to nine of water, or the three gallons with twenty-seven of water, making, in all, thirty gallons when ready for use. The emulsion should be applied with a garden syringe and through a fine rose or spraying nozzle, or any of the modern spraying force pumps may be used for the purpose. When the emulsion is to be applied to miscellaneous plants in a greenhouse I have found that one gallon of kerosene to one-half pound of the soap, and the usual amount of water, was strong enough to kill aphis and mealy bugs, and less likely to injure the foliage than when made of full strength.

Quite recently another of these mealy bugs, or scale insects, has been discovered infesting grapevines, especially those growing in village and city gardens. I refer to the Cottony Maple Scale (*Pulvinaria innumerabilis*, Rathvon). For many years this pest was supposed to attack only the Osage Orange and the Western White, or Soft Maple (*Acer dasycarpum*). As this species of maple is a much more rapid growing tree than either the common Red Maple (*A. rubrum*), or the Sugar Maple (*A. saccharinum*), it long since became very popular as a street shade tree in many of our Eastern cities and villages, and it is now thought that this Maple Cottony Scale was introduced with it from the Western States. But it does not matter how the pest was introduced, it is enough to know that it is here, and in unnumbered millions, not only on the two species of soft maples, but, to a limited extent, on the sugar maples; and from these it swarms and passes to grapevines, American and Japan ivies, and various other vines and shrubs. The many thousands of soft maples planted in the streets and parks of some of our Eastern cities are, at this time, a reeking mass of these filthy insects and their excretions.


FIG. 93.

These insects appear on the trees and vines in the form of oblong brown scales, Fig. 93, varying in length from one-fifth to one-third of an inch. Under and around these scales there is a white, fluffy, cottony mass, which, in May and June, is filled with minute eggs, and to the number of from six hundred to one thousand. During June and July these eggs hatch and the young lice spread in various directions, but soon settle down on the underside of the leaves, and insert their beaks and begin to pump out the sap for food. At this time these lice secrete a sweetish liquid, which soon coats the upper sides of the leaves upon which it falls; much of it, however, falls to the ground, coating the grass, weeds or sidewalks underneath, catching and holding any dust that may be flying about at the time. These nectar-like excretions also attract flies, bees, wasps and similar insects. Later in the season the lice pass from the leaves to the branches of the trees, usually locating on the underside, where they will be slightly sheltered from storms. On grape-vines they usually cluster near the lateral twigs on the large annual canes, but sometimes on the older stems.

Kerosene emulsion will destroy these Cottony Scales, and the best time to apply it is in the fall, soon after the fruit is gathered, and repeat the application in spring, just before the vines begin to grow. All the wood pruned from infested vines should be burned, and not used for propagation.

The Grape-Leaf Louse (*Phylloxera Vastatrix*).—Long before the first edition of this work appeared the cultivators of our native varieties of the grape had occasionally noticed small galls on the leaves, but most frequently on those of the Clinton. These galls, however, attracted very little attention, probably because they did not seem to seriously interfere with the growth of the plants; besides, they were not constant; some seasons being very abundant, then again almost, or quite, disappearing. It was not until the year 1856 that we find any published reference to these galls, and this appeared in the first annual report of the late Dr. Asa Fitch, the State entomologist of New York. Dr. Fitch merely refers (p. 158) to the "grape-leaf louse," to which he gave the name of *Pemphigus vitifoliæ*, and says "that it inhabits galls upon the margin of the leaves." "They are of a red, or pale yellow color, and their surface is somewhat uneven and woolly. They are met with the fore part of June, having only the wingless females enclosed within them."

He again refers to this insect in his third report, but in such a brief and vague manner that it is evident that he really knew very little of the habits of a pest which was soon to destroy many thousands of acres of the old and long established vineyards of Europe.

The introduction of several new and promising varieties of the native grapes, notably the Delaware, Diana, Iona and Concord, during the decade between 1850–60, gave a new and somewhat surprising impetus to grape culture in this country, and the demand for vines became so great that, for a time, many of the nurserymen made the propagation of the newer varieties a specialty, both in the open ground as well as under glass, while many other persons who had not previously been in the business entered it, with more or less enthusiasm, and, in some instances, erecting extensive ranges of houses for the sole purpose of rapidly propagating all the newer, as well as older varieties which were in demand. Among the largest and most noted establishments of this kind, that of the late Dr. C. W. Grant, of Iona Island, near Peekskill, N. Y., became the most famous, and remained so for several years.

About 1859 it was noticed that the young vines were somewhat defective in their roots, and galls, from the size of a pinhead, and up to that of small peas, were more or less numerous on the fibers of those raised in the houses, and, later, the same kind of galls on vines planted in the open ground on the Island. During the season of 1860–61, and later, these root-galls became so abundant that a system of combing was practiced, to remove them before the vines were sent out to customers. I have, myself, seen heaps containing several bushels each, of these galls, that had been combed from the roots of pot-grown plants as they were being prepared for sale. Neither Dr. Grant nor any of his assistants knew what caused these galls on the roots, but it was supposed, at the time, they were due to either over-stimulation and a forced growth, or to some defect in the soil. It is quite probable that these galls were to be seen on vines in other establishments where vines were propagated under glass, but I had no occasion, at the time, to make any extended investigation in this direction; consequently, cannot speak from personal knowledge on this point. A few years later we began to hear of the outbreak of a serious disease in the vineyards of France, and for a time it was supposed to be a fungus, causing a rotting, or *pourridis,* as it was designated by the French vineyardists. In the spring of 1868, Prof. J. E. Planchon, of Montpelier, announced that the malady was caused by the puncture of a minute insect of the plant-louse family of *Aphididæ,* and bearing a close resemblance to the gall-louse so often seen on the leaves of the Clinton and a few other varieties of the grape in this country. Later in the same year Prof. Planchon had so carefully and thoroughly studied this pest that he was enabled to fully describe it in its various stages, and then he gave it the name which it now bears, viz., *Phylloxera vastatrix.* But Prof. Planchon was not aware, at the time, that the insect he was investigating, and which was ravaging the vineyards of France, was the same pest that lived in the galls on the leaves and roots of vines here, and the credit of discovering the identity of the two is due to Dr. C. V. Riley, then State entomologist of Missouri, and later chief of the Division of Entomology, U. S. Department of Agriculture.

Dr. Riley's investigations of this pest have been exceedingly thorough, and extending over many years, leaving, as it would seem, very little more to be learned in regard to its habits and history. The literature of the subject has become so extensive that it would require a dozen good sized volumes to give even an epitome of what has been published in this country, to say nothing of the voluminous reports of specialists which have appeared in France and other European countries; consequently, want of space compels me to refer only to some of the more prominent characteristics of this insect.

As is now well known, there are two distinct forms, or types, which are very constant; one, the *gallæcola,* lives in galls on the leaves; the other, called *radicicola*, on the swellings, or galls of the roots. In and about these root-galls winged and wingless lice of both sexes, also the eggs and larvæ, are to be found, on infested vines during the summer and autumn months; in fact, these pĕsts appear to reach their most perfect stage among the roots. Those inhabiting the leaf-galls, being females only, and, like other species of the *Aphidæ*, increase by parthenogenetic maternity for several generations in succession; that is, every egg laid by the mother louse brings forth a fertile female, and this process continues until all the leaves on the vines are destroyed, or the cool weather checks growth; the late, or last generation of lice seek the roots, where they hibernate, either in the egg or larvæ stage.

During the rapid and forced propagation of the American varieties of the grape, which began about 1858, and continued during the following ten years, the *Phylloxera* was widely distributed and flourished on nearly all slow-growing and enfeebled vines. In 1865 I planted a specimen vineyard of some two hundred varieties, and a large number came from Iona Island, and some from other establishments where propagating under glass was practiced, and, as a result, the *Phylloxera* was introduced and appeared to thrive on all the hybrids and most of the varieties not adapted to my soil and climate. When Prof. Planchon came to this country to investigate the *Phylloxera*, in 1872, under the auspices of the French government, he spent a day in examining the vines in my grounds, and, as I had concluded to destroy my specimen vineyard, I allowed him to dig up as many vines as he wished to examine, and, I will say, we found root-galls in great abundance. The following year I dug up and burned every one of the two hundred varieties and set a new plantation, using only healthy plants.

I have employed no remedies or preventives, and now, after twenty years, can say that no pure native variety has been seriously injured since by this pest. The *Phylloxera,* being a native insect, it is not at all likely to ever become a serious pest in our eastern vineyards, because the indigenous species are capable of resisting its attacks unless they are enfeebled by forced propagation, neglect of cultivation, or planting in uncongenial soils and climates. It is, however, a destructive pest to all foreign varieties, and many hybrids, as the vineyardists of Europe have learned, to their cost. It is now believed, and it is probably true, that this insect has been the principal cause of the failure of all the vineyards planted with European varieties in the eastern States during the last century, and in the early years of the present one. Mildew and black rot, and other fungus diseases, may have, also, been enemies; but, whatever the cause, it is well known that the foreign varieties do not thrive anywhere in the United States east of the Rocky Mountains. In California, however, they have been cultivated with great success, and for many years; but the *Phylloxera* has appeared in the vineyards of that favored region, and what the results will be time alone must determine.

In the way of remedies there is little to be said, because there are none that have, as yet, proved effectual under all conditions. In France the employment of the most vigorous of the American species for stocks upon which to graft the foreign varieties, has been extensively practiced, with excellent results; but this comes more in the line of preventives than a destroyer of the pest, and, in my opinion, the vineyardists of the Atlantic States have only to plant clean, healthy vines of the well known native resistant varieties, and then give them good cultivation and judicious pruning, to escape any serious loss from the attacks of the grape *Phylloxera.* Of course care will ever be required in the selection of congenial soils and locations for vineyards, because, if the vines become weak and feeble from any cause, they are sure to be attacked by parasites of some kind, for it seems to be a universal law of nature, in both the animal and vegetable kingdom, that nothing possessing life lives very long after it loses the power of resisting its natural enemies.

CHAPTER XX.

FUNGUS DISEASES.

Until quite recently very little was known of the nature or habits of the fungus diseases of the grape, beyond the bare fact that they were frequently very destructive in all parts of the country east of the Rocky Mountains. Collectively they were enemies which the vineyardist sought to control, but with very unsatisfactory results. In some instances dusting the vines with lime, sulphur, or both combined, seemed to check these diseases: then, again, all remedies failed. Many of the earlier vineyards of Ohio, and throughout the Mississippi valley, as well as those in the east and south, were abandoned, owing to the prevalence and destructiveness of the diseases known under the names of mildew and black rot. But the planting of new vineyards continued, the inexperienced, as well as experienced vineyardist trusting to luck, or skill, for obtaining remunerative crops of fruit. That many were successful is evident, from the constantly increasing amount of fine grapes received in all of the larger cities and villages, besides the many hundreds of tons annually used in making wine. But successful as grape culture, as an industry, has become, there are still many failures, owing to the prevalence of fungus diseases.

To investigate these thoroughly and discover remedie could scarcely be expected of individuals, and, happily it was not necessary, for the problem has been fully an satisfactorily solve for us in France where there is no ces sation of experiment al work in field an vineyard, and all cor ducted under the aus pices of the goverr ment and variou schools of agricultur Ever since the reme dies for fungus di eases of the grap were given to the pub lic—some half doze or more years since– the reports of th Department of Ag riculture at Washing ton, and the bulletin of the State Exper mental Stations, hav teemed with advice t vineyardists, an fruit growers in ger eral, all recommend ing the French fung cides as the best yet discovered. War of space will prever me from giving mo than a very brief d scription of the mo

FIG. 94.

destructive fungi attacking the grape in this country, and in doing that I shall avail myself of an excellent report on "Fungus Diseases of the Grape, and Their Treatment," by B. T. Galloway, chief of the division of Vegetable Pathology, U. S. Department of Agriculture.

"There are but four fungus diseases of the grape in this country which occasion sufficient damage to warrant our attention, and they are (1), The grape *Peronospora*, or downy mildew; (2), powdery mildew; (3), black rot; and (4), anthracnose."

Grape Peronospora, or Downy Mildew, Brown Rot and Gray Rot.—The fungus causing these diseases is known to botanists as *Peronospora viticola*. It attacks the leaves, young wood, flowers and fruit. On the leaves it usually manifests itself first in the form of greenish yellow, or brownish spots on the upper surface, while on the lower side corresponding parts are covered with a white, frost-like growth. As the disease progresses the frost-like patches may disappear, leaving only the brown leaf, which soon dries up and falls off. Young wood and flowers are affected in the same way, and the young berries, if attacked, usually cease growing and appear as shown in Fig. 94. This form of the disease is known as the downy mildew, and in some sections it causes the only serious damage. On the fruit the fungus occurs in two forms, causing what is known as brown, or gray rot. The former disease, as a rule, does not make its appearance until the berries are nearly grown. At this time a brownish-purple spot will appear on one side of the berry, and in a short time the whole fruit is involved, turning brown, and ultimately becomes soft and wrinkled. In gray rot the fruit is covered with the same frost-like growth seen on the leaves. The berries are literally plastered together with the fungus.

Powdery Mildew (*Uncinula spiralis*).—This usually appears about midsummer, attacking the leaves, young wood and berries. Occasionally, however, it appears earlier in the season, and in such cases is often very destructive to the plants. It forms on the various parts attacked, a powdery, mealy growth, this being very marked on the leaves, where it is usually more abundant upon the upper surface. The berries attacked often crack, exposing the seed in a very peculiar manner. Upon close examination of any part of the vine affected with powdery mildew, fine delicate threads, which make up the vegetative portions of the fungus, may be seen. This, in itself, is enough to distinguish the disease from downy mildew, the only malady for which it is likely to be mistaken.

Black Rot (*Laestadia Bidwellii*).—This is such an old, widespread, and well known disease, that it is scarcely necessary to describe it. But there may be some vineyardists who do not know that the fungus usually appears first on the leaves and young shoots, in the form of reddish brown, or black spots, and some two or three weeks later it attacks the berries, and the first indications of its presence on these are one or more brown, or blackish spots on the skin. The fruit soon turns brown, then black, and finally becomes hard and ceases to grow, and withers upon the stalks. Fig. 95.

Anthracnose (*Sphaceloma ampelinum*), is caused by this microscopic fungus, and, like the downy mildew and black rot, it attacks the leaves, young tender shoots, and the immature berries. The leaves, when first attacked, show minute blackish-brown spots, which are surrounded with slightly raised darker colored margins. On the shoots the disease appears very much as it does on the leaves, but as it progresses the spots become darker at the center, and often run together, forming elongated patches, which gradually eat their way into the wood.

Anthracnose on the fruit is usually called bird's-eye rot, and first appears as a blackish or brown circular

FIG. 95.

spot surrounded by a narrow dark rim. As the spots increase in size the color undergoes various changes; sometimes there is a zone of vermillion surrounding a grayish center. The berries may shrivel up, or be developed unequally, the affected side being somewhat flattened.

Remedies and their Preparation.—There are four fungicides which extended experiments have shown to be efficacious in checking and destroying the fungus diseases described. These are (1), a simple solution of copper sulphate; (2), the Bordeaux mixture; (3), the ammoniacal solution of copper carbonate; and (4), eau celeste. There may be other fungicides equally as good, but the preceding have been thoroughly tested and recommended by those who have used them the most extensively.

Simple Solution of Copper Sulphate.—This is prepared by simply dissolving one pound of the copper sulphate in twenty-five gallons of water.

Bordeaux Mixture.—The formula now in general use is that containing six pounds of copper sulphate and four pounds of lime and twenty-two gallons of water. The sulphate should be dissolved by throwing it into about a half barrel of water, stirring it occasionally to hasten the operation. In another vessel slake the lime with sufficient water to make a thin whitewash, and then pour this into the barrel containing the sulphate, straining it through an old sack to remove sticks and undissolved pieces of lime. Fill up to make the twenty-two gallons, and the solution is ready for use. Of course, a larger or smaller quantity may be made at one time, preserving the proportions of the ingredients very nearly, although slight variations will scarcely be noticed in the results. If the mixture should spot the leaves, then reduce the proportion of the sulphate.

Ammoniacal Solution of Copper Carbonate.—In an ordinary water pail dissolve five ounces of copper carbonate in three pints of spirits of ammonia having a strength of 26°. If the three pints of ammonia are not sufficient to completely dissolve the copper, add as much more as required. When fully dissolved pour the solution into a barrel and fill up with water.

Eau Celeste.—Dissolve two pounds of copper sulphate in eight gallons of water, and when thoroughly dissolved add three pints of spirits of ammonia, and dilute to fifty gallons. Where the vines have thin leaves this solution will sometimes burn or spot the foliage, and a modified formula is preferable, *viz.*: Dissolve four pounds of the copper sulphate in ten or twelve gallons of water. Add three pints of ammonia, and dilute to fifty gallons, then add five pounds of common washing soda. Stir or allow to stand until the soda is dissolved, and the solution is ready for use.

These remedies are not given because it is supposed that they will be required in all localities, for there are many in which none of the fungus diseases have, as yet, been sufficiently destructive to cause any serious loss, but whenever required, it is well to know that remedies are at hand and may be applied at a cost of not more than two or three cents per vine. There are also some varieties far more susceptible to the attacks of the microscopic fungi than others, and in case they are worth preserving, the fungicides should be applied; but, as a rule, I do not think vineyardists will care to cultivate varieties which require constant dosing to keep them in a moderately healthy condition, at least, not with the present price of grapes in our markets.

Application of Remedies.—For the downy mildew and gray rot, either of the solutions described will answer very well; but the ammoniacal copper carbonate is usually preferred, because the cheapest, and less liable to injure the foliage. The first application should be made about the time the fruit is well set on the vines, and then repeat the spraying every two weeks until the fruit begins to color. The eau celeste is said to be preferred by the vineyardists of Ohio, for the downy mildew, and in some other northern localities, but in the Middle and Southern States it appears to injure the foliage more than the simple carbonate copper solution. For powdery mildew alone ammoniacal copper carbonate solution is recommended, but almost any of the copper solutions will answer. Unfortunately, however, the powdery mildew seldom exists alone, and for this reason it is better to apply the Bordeaux mixture or eau celeste at once, and destroy the various species of fungi which may be present on the vines.

In treating the vines for black rot, the first application of fungicides should be made early in spring, before the buds begin to swell, and with the simple solution of copper sulphate. Then, when the leaves are about half grown, apply Bordeaux mixture, and, a few weeks later, spray with ammoniacal carbonate solution. But the treatment is greatly varied, some vineyardists preferring one fungicide, while others depend entirely upon the simple solution of copper, or use this and the Bordeaux mixture alternately. For anthracnose the Bordeaux mixture is most extensively used, and appears to give the best results.

Method of Applying Remedies.—The application of all the various fungicides should be in the form of a fine spray, in order to reach every part of the vine. By such means a very small quantity of the solution is made to wet a very large surface, and without drenching the vines. This is now quite practicable with almost any of the modern spraying pumps, of which there are many forms and sizes to be obtained of dealers in agricultural and horticultural implements, and in almost every city and village in the country. If the amateur with a few vines does not care to purchase an expensive apparatus, he can do good work with one of the common brass syringes such as florists often use in their green-houses, for applying kerosene emulsion and other liquid insecticides.

CHAPTER XXI.

DESCRIPTION OF VARIETIES.

Of the one hundred and thirty varieties named and briefly described in the first edition of this work (1864), scarcely more than a dozen can be admitted into the present list of varieties worthy of cultivation. Nearly all of the others have either become obsolete, or merely retained, in some of the larger collections of native grapes. But new varieties have been raised in immense numbers, of late years, and it would not now be at all difficult to double my former list, and then not exhaust the names of highly extolled favorites to be found in nurserymen's catalogues, and of those who make the propagation of the grape a specialty. The ephemeral life of a large proportion of the older sorts warns me not to place too much confidence in the new; and yet it must be admitted that the cultivators of this fruit have learned much by observation and experience during the past three decades; consequently, they are better able to judge of the real merits of the new and untried varieties than ever before. That this experience is producing excellent results is quite apparent, in the improved flavor of some of the newer varieties disseminated within the past few years, by those who make a specialty of raising seedlings; for they have learned that cultivators are seeking something better than those which they have previously possessed, and if such cannot be had it would be folly to attempt to make a change. Some few of the old favorites, like the Concord, Catawba and Delaware, hold their own, and even lead in the market, however closely pressed they may be by more recent productions.

Rogers' Hybrids, which at one time gave promise of being valuable acquisitions, have lost ground rapidly, and of the twenty or more of those first introduced and disseminated under numbers, and later by name, not more than a half dozen remain in general cultivation, and of these few are ever seen in market. Just why these grapes were pushed aside it might be difficult to determine, for there are really some good and valuable varieties among them, and these show very little, if any, of the foreign blood which it was claimed they possessed.

A few years later another and very distinct lot of hybrids were introduced by Mr. J. H. Ricketts, of Newburgh, N. Y., whose skill as a hybridizer of the grape has probably never been surpassed in this or any other country. But, unfortunately, he selected poor material for the foundation of the structure he hoped to build; for the foreign blood (*Vitis vinifera*), when intermingled with that of our native species, has always proved to be an enfeebling element in this climate, and very few varieties of such a mixed parentage have ever become popular with vineyardists. Perhaps, with the free use of the recently approved fungicides, some of these hybrids may become worthy of more extended cultivation, and it might be well, for those who have the means and inclination, to give them a fair trial under such conditions.

Many other hybridists are in the field, and some of their productions are, to say the least, promising, but it is well for the practical vineyardist to keep in mind the fact that a variety may succeed in one locality, and not in another, and for this reason we are rarely enabled to determine its value from a single vine, or even a half dozen, growing in the grounds of the originator, or those of some friend who is coddling the plants because they are new, rare, and believed to be very precious. It is only when varieties enter into general cultivation, or over an extended region of country, that we can begin to form some idea of their commercial value, and no matter what our individual tastes may be, we must cater to that of the general public if we expect to get a fair return for our labor in the vineyard. Of course, I am not disposed to inveigh against the special favorites of the vineyardist, nor of the amateur with only a vine or two in his garden, for these usually afford the cultivator the most pleasure and yield fruit far superior to that grown for market. A smooth, agreeable flavor, even if it is not rich, will better suit the masses than a rich fruit with peculiar flavor, for these will only suit people with peculiar individual tastes.

A grape that possesses but very little sugar and very little acid may be agreeable, but not rich; for a fruit, to be of the best quality, must contain both sugar and acids in abundance, along with the other ingredients that are found in all good grapes. The Isabella, which so long held the foremost place in the markets of the Eastern States, is one of those feeble flavored, agreeable varieties, and the Concord, which, during the past two or three decades has taken its place, belongs to the same group and species, and, while it is far from being either rich or delicious, it is passably good and agreeable to those who have not been accustomed to anything better. The fruits that are most readily accepted by the great majority of consumers are those which do not possess any very pronounced distinctive flavor, although it must be admitted that long continued familiarity and use has, in many instances, tended to lead people to tolerate, and even acquire a taste for, rank and distinctive flavors in both food and luxuries.

There has been, and there is still, much discussion as to what constitutes best quality in a grape, and so long as we allow some particular characteristic to be our guide, instead of the whole, we shall never settle the question. One person admires a large grape, while another cares nothing about size, but wants sweetness; while still another accepts acidity as less cloying than too much of the saccharine; but these are only matters of taste, and do not affect quality; for quality in a grape is essentially a compound, while taste is simple.

Some of the requisites of a grape of first quality, and belonging to our indigenous species are: 1st. A

FIG. 96.

FIG. 97.

FIG. 98.

FIG. 99.

FIG. 100.

FIG. 101.

large amount of sugar. 2d. A large amount of acid. 3d. A brittle, tender pulp; if it is nearly a liquid so much the better. 4th. No strong distinctive flavor. 5th. Large and moderately compact bunch. 6th. Large berry. 7th. Small seeds. 8th. Berries adhering firmly to their peduncles. 9th. Thin skin, but sufficiently tough to prevent bursting.

These characteristics refer more particularly to table grapes, as wine grapes may possess particular characters and flavors that would detract from their value as dessert fruits, and still be unsurpassed for wine. The most popular dessert grapes are seldom the best for wine, or, at least, they are less frequently used for this purpose. The form and corresponding size of our native varieties may be seen by reference to the following figures: Fig. 96 is what is usually termed small; Fig. 97 medium; Fig. 98 large; Fig. 99 very large; these are all round, or spherical; Fig. 100 oval; Fig. 101 oblong oval, a rare form among our native varieties.

In the following list I shall only attempt to name the best of the well known varieties, which are believed to possess sufficient merit to make them worthy of being retained in cultivation. This will be followed with another, containing the names of the principal new varieties, or those which have not been sufficiently disseminated to allow their merits to become well known among grape growers, but are supposed to give promise of becoming valuable. In the third section the old, obsolete, worthless and doubtful varieties will be catalogued, as a kind of historical record of the fruits which, in their day, served as incentive to the vineyardist to seek something better.

Agawam (*Rogers' Hybrid No.* 15).—Bunch large, loose, usually shouldered. Berries large, skin thick, red or amber; pulp rather tough, but juicy, with an aromatic sweet taste when fully ripe. Vine a rank grower, with large, thick leaves, somewhat subject to mildew in some localities, and this may account for its limited cultivation, although introduced more than thirty years ago.

Antoinette (*T. B. Miner*).—Bunch medium to large; compact, shouldered. Berries large, skin thin, very tender, greenish-white at first, changing to yellowish-white when fully ripe. Pulp tender, very sweet and rich. A seedling of Concord, with all the characteristics of its parent in the way of leaf and vine, but with light-colored and much sweeter and richer fruit; ripening two weeks earlier than Concord. During the twenty years this variety has been growing in my grounds it has never suffered from disease, and while I consider it one of the best white grapes in cultivation for home use, it will scarcely answer for market, owing to the tender skin and the dropping of the berries from the bunch when handled after they are fully ripe.

Augusta (*T. B. Miner*).—Bunch medium, compact, sometimes shouldered. Berries medium to large; skin thin, greenish-white, becoming decidedly yellow and semi-transparent when fully ripe. Pulp tender, sweet and rich. Very early, or with the Delaware. Of the same origin and parentage as the Antoinette, but not as strong and vigorous. A beautiful grape for the amateur or the home garden of the vineyardist.

Bacchus (*J. H. Ricketts*).—Bunch medium, very compact, shouldered. Berries small or medium; black, pulp tender, too acid to be pleasant. A seedling of the old Clinton, and, like its parent, very hardy and productive. Recommended only as a wine grape for Northern localities.

Barry (*Rogers' Hybrid*, 43).—Bunch large, and short, not generally shouldered. Berries large to very large; skin moderately thin, black, with little bloom; pulp tender, sweet and sprightly when fully ripe; vine hardy, vigorous and productive; season medium, or ripening with the Concord. One of the best of Rogers' Hybrids, and perhaps the least liable to be attacked by mildew and black rot.

Brighton (*Jacob Moore*).—Bunch large, broad, but short, sometimes double-shouldered, or clustered. Berries medium to large, reddish-purple; skin thin, with light bloom; pulp tender, and more like the flesh of the foreign varieties than of our native grapes. In flavor it is sprightly and very pleasant, and an excellent grape. Vine vigorous, and usually productive when not attacked by disease. A hybrid between the Concord and Diana Hamburg. Very highly recommended by those who have been successful in its cultivation, and its range will probably be largely increased as vineyardists become more familiar with the remedies employed for preventing diseases.

Catawba.—Bunch large, loose shouldered. Berries medium to large; skin thin, dark red, with thin bloom; pulp tender when fully ripe, with a juicy, rich and sprightly flavor. This old favorite has held its own against all competitors for three-quarters of a century, and during the closing days of the year it is about the only native dessert grape to be found in our markets. It ripens rather late for some of our Northern States, and in some localities is subject to mildew and black rot, but now that it is known that these diseases are not incurable, the old Catawba may take a new lease of life, and long remain a standard wine and table grape.

Champion.—Origin unknown. Bunch medium, compact. Berries large, black; pulp rather tough; sweet, with a decided foxy flavor. Resembles Hartford Prolific, but it is claimed that the berries adhere more firmly to the stem. Very hardy and prolific, but mainly recommended on account of earliness.

Concord (*E. W. Bull*).—Bunch compact, large shouldered. Berries large, round, black, thickly covered with a beautiful blue bloom. Skin thin, often very thin. Flesh moderately juicy, sweet, rather buttery. Pulp quite tender when fully ripe; sometimes quite acid at the center, with considerable of the foxy flavor. Vine very hardy and vigorous. Leaves very thick and enduring; dark green above, rusty beneath. Ripens from 10th to 20th of September.

Among all the varieties that have been thoroughly tested, the Concord is, without doubt, the most profitable for market. It will grow and produce abundant crops in situations and upon soils where some of the better flavored and more delicate varieties would utterly fail. Although its fruit cannot be called the best in quality, still it seems to suit the masses; or at least they prefer an abundance, if it is not quite so delicate, to a small supply of something that is really superb.

It is a really fine native grape, and has steadily grown in favor ever since its introduction, and probably there are more vines of it being planted at the present time than of any other variety. It is very hardy, of vigorous growth, and very productive. Its beautiful appearance makes it one of the most attractive market grapes, and for this purpose there is, perhaps, no variety that excels it.

The preceding paragraphs contain my description and opinion of this popular grape, as published thirty years ago, and I cannot now see any good reason for making any change; for the planting of the vines is still going on, although the few hundreds of pounds which found their way to market in 1864 are now represented by almost, if not quite, as many tons.

Cottage (*E. W. Bull*).—A seedling of the Concord, resembling its parent, the individual berries being a little larger. The skin is thicker and the pulp somewhat tougher, and while I do not think it as good as the Concord, others may not agree with me, hence its place in this list.

Dana (*Francis Dana*).—Bunch medium, compact, shouldered, peduncle of a reddish color. Berries large, red, with considerable bloom; pulp quite tender and sweet. Ripens with Concord, or from the first to middle of October. Vine vigorous, hardy and productive.

Delaware.—Origin unknown, but first brought to notice by Mr. A. Thompson, of Delaware, Ohio, who procured it of Mr. Paul H. Provost, of Hunterdon Co.,

N. J. Bunch medium, very compact, and generally shouldered. Berries medium; skin thin, of a beautiful dark red color when fully ripe, and with only a slight white bloom; pulp tender and juicy, sweet, with a sprightly, vinous flavor. This variety has become a standard of excellence among our native grapes. The vine is very hardy, young wood exceedingly hard when mature. A sturdy grower, but not as rank as some other native varieties. It is probably a seedling of the Catawba, as it possesses many of the characteristics of that old favorite, but ripening a month earlier, and while the fruit is much superior in quality to that of its supposed parent, the vine is less vigorous, consequently requires a much richer soil and more care in cultivation.

Diamond (*Jacob Moore*).—A cross between the Concord and Iona. Bunch large, slightly shouldered. Berries large; skin thin, but firm, greenish-white at first, but becoming yellowish with full maturity. Pulp tender, sweet, and rich flavored. The vine is vigorous, healthy, hardy and productive. While this is a comparatively new variety, it has been so widely disseminated, and its merits so well known, that I think it safe to place it among the standard varieties.

Diana.—A seedling of Catawba, raised by Mrs. Diana Crehore, of Boston, and introduced to public notice about thirty-five years ago. There is probably no one variety of grape in cultivation in regard to which there is a greater diversity of opinion, and its variableness fully warrants all that is said about it. In one section it is really excellent, while in another, perhaps near by, it is entirely worthless; and the same difference is often observable in the same garden, and from no apparent cause. It is one of the best keeping grapes that we have, owing, in a great measure, to its thick skin.

Bunches medium to large, compact, not generally shouldered. Berries medium, sometimes quite large, round, often ripen very unevenly. Skin thick, pale red, covered with a thin bloom. Flesh tender, with some pulp, juicy, rich, sweet and vinous; but in some seasons and localities it possesses a peculiar musky flavor that is, to many persons, quite offensive. After the fruit has been gathered a few days this peculiar flavor, in a measure, disappears. Vine vigorous and moderately hardy, requiring slight protection in our Northern Border States. Ripens the last of September in the latitude of New York City.

Duchess (*A. J. Caywood*).—Bunch large, shouldered. Berries medium; skin thin but firm, greenish-white; pulp tender, juicy and sweet. Vine hardy and prolific, but much subject to disease, except in a few favorable localities.

Eaton (*Calvin Eaton*).—A seedling of Concord. Bunch large, sometimes double shouldered. Berries extra large, round; skin thick, black, covered with a delicate bloom, but not quite as abundant as on the berries of its parent. Pulp rather firm, but juicy; neither sweet nor rich, and, to my taste, very much inferior to the Concord. Vine healthy and hardy; a good show fruit, but not up to the standard of excellence for a dessert grape.

Empire State (*J. H. Ricketts*).—A cross between Hartford Prolific and Clinton. Bunch rather long, large, and usually shouldered. Berries medium, skin thick, but tender; greenish-white tinged with yellow at maturity; very little bloom; pulp tender, sweet, rich and sprightly. Vine hardy, healthy, and productive, as might be expected from such parents. This is one of the very best of Mr. Ricketts' seedlings for general cultivation, probably because it is of pure native parentage.

Goethe (*Rogers' No.* 1).—Bunch large, shouldered. Berries large and of a decided oval form. Skin thick, pale red, or flesh color, when fully matured; pulp tough, with a little rich juice, having a rank, foxy flavor. Vine a coarse, rampant grower, and very productive. It is with much reluctance that I have admitted this grape here, because, after twenty-five years' experience with it, I must say it has scarcely a redeeming quality beyond that of size and peculiar shape of berries. But it is extensively propagated and admired, and this might lead my readers to look for it among the recommended varieties.

Green Mountain, or Winchell.—Origin unknown, but said to have been found in a garden in Vermont. Bunch medium, shouldered. Berries medium, skin greenish-white, thin; pulp tender, sweet and excellent. Vine very hardy and productive. This grape is highly recommended for its early ripening and good quality. Its value for general cultivation for market has not, as yet, been determined.

Hartford Prolific.—A very old variety, supposed to have been raised by a Mr. Steel, of Hartford, Conn. Bunch medium to large, shouldered, and compact. Berries large; skin rather thick, black, with very little bloom. Pulp somewhat tough, but sweet, and with a decided foxy flavor. Vine hardy and very productive. Valuable for its earliness, ripening two weeks in advance of Concord. It is not a good market grape, on account of the tendency of the berries to drop from the bunch.

Hayes (*Jno. B. Moore*).—Bunch medium to large, compact, shoulders very small, or none. Berries medium; skin tender, greenish-white, with an amber shade when fully matured; pulp tender and juicy, and of excellent flavor. Vine vigorous and hardy, with large, healthy foliage. Ripens a little in advance of the Concord.

Ida (*T. B. Miner*).—Seedling of Concord. Bunch large, heavily shouldered. Berries as large as those of its parent; skin moderately tough, deep green, fading to pale green when dead ripe; skin moderately firm; pulp tender and juicy, sweet and rich. Vine almost identical with the Concord, hardy and productive. The color is against this most excellent grape, which I received from the late Mr. Miner in 1877, and have had in continuous cultivation ever since. It is to be feared, however, that of the dozen or more excellent varieties raised and distributed by Mr. Miner, few can now be identified with any degree of certainty. Some have, no doubt, reappeared under new names, with origin falsely claimed or unknown.

Iona (*Dr. C. W. Grant*).—A seedling of Catawba, raised at Iona Island, about thirty-five years ago, and a superior fruit, but the leaves are rather thin and very likely to be attacked by mildew. Bunches large, shouldered, compact. Berries large, round, semi-transparent when they begin to ripen, but growing opaque as the color deepens. Skin thin, pale red, with small deep red veins at first, changing to dark red when fully ripe. Flesh tender, with very little pulp at the center. Sweet, brisk flavor, excellent, but not quite equal to Delaware. Ripens from 10th to 20th of September.

Isabella.—Supposed to have been brought from South Carolina to New York by Mrs. Isabella Gibbs, early in the present century. It has probably been disseminated under more names than any other native variety in cultivation. Bunch large, compact, shouldered. Berries medium to large, slightly oval; skin thin, black, with light bloom; pulp tender and sweet; excellent quality when perfectly and well ripened. Of late years the vine has been subject to disease, and for this reason few are now planted, the Concord having almost entirely superseded this old favorite.

Jefferson (*J. H. Ricketts*).—Said to be a cross between the Concord and Iona. Bunch large, often double shouldered. Berries large, of a red color; skin moderately thin; pulp tender, sweet and rich. Vine hardy, healthy and prolific. Ripens with the Iona, or a little earlier than Concord. A very promising variety, but not, as yet, very widely disseminated nor extensively cultivated.

Jessica.—Originated with D. W. Beadle, Canada. A small white grape, which has been widely disseminated, and highly recommended for its earliness and productiveness, but with me it is utterly worthless, the vine being a feeble grower, and both fruit and leaves are so subject to mildew that I do not consider it worth cultivating.

Lady (*C. W. Campbell*).—A seedling of Concord. Bunch medium, compact, rarely shouldered. Berries large, skin thin and brittle, greenish-white; pulp tender and sweet, but not very rich. Ripens early, or a week or more before the Concord. Vine a moderate grower, hardy, but not very productive.

Lady Washington (Hyb.) (*J. H. Ricketts*).—A hybrid between Concord and Allen's Hybrid. The originator was probably awarded more prizes for this variety than for all the many he produced, and yet it does not seem to have become at all popular with vineyardists anywhere. Bunch large, compact, usually double shouldered. Berries large, yellowish-green, with thin bloom. Flesh tender, sweet and delicious. Vine vigorous and productive in the originator's grounds, but rarely seen in this condition elsewhere. Ripens late, under the most favorable conditions, and may prove more valuable South than in the North.

Martha.—A well known variety raised some thirty years ago, by Judge Samuel Miller, now of Bluffton, Mo. Bunch medium, compact, uniformly shouldered. Berries medium, skin rather thick, pulp sweet, juicy, with a slightly foxy odor, but not offensive. Vine very hardy, healthy, and exceedingly productive. A standard variety, ripening with or a little before the Concord,

Moore's Early (*Jno. B. Moore*).—Bunch large and compact. Berries large, skin thick; black, with heavy bloom; pulp tender and juicy, but not very sweet nor rich. Vine hardy and prolific. Recommended mainly on account of its earliness, as it ripens about two weeks before the Concord.

Moyer.—Originated in Canada, and in the grounds of Mr. Allen Moyer. It is probably a seedling of the Delaware, which it resembles in both color and earliness. Bunch small, or very small, sometimes shouldered. Berry small, skin thin, red; pulp tender, and exceedingly sweet and delicious; but, unfortunately, there is little of it, for the berries are very small, with large seeds. A very fine early grape, but too small to ever become popular.

Niagara.—Introduced by Hoag & Clark, of Lockport, N. Y. It is, undoubtedly, a pure native variety of the Labrusca, or fox grape species. Disseminated and propagated by a syndicate, each vine sold under *seal*, with some other rather unusual schemes for attracting public attention. Bunch large to very large, shouldered. Berries large; skin tough, green, retaining this color, fading but little when fully mature. Pulp firm and rather tough; juice moderately sweet and good, but with considerable of the native fox grape odor. Ripens with Concord. Vine healthy, hardy, and very productive. In some localities it is said to be affected with mildew, and the fruit with rot, but the same may be said of all the varieties of this species. The Niagara is, without doubt, a valuable grape for market; it is large and handsome, and firm enough to bear transportation without injury to its appearance, and good enough to satisfy those who are not accustomed to anything better in the way of a light-colored grape.

Pocklington (*Jas. Pocklington*).—A seedling of Concord. Bunch large and very compact, slightly shouldered. Berries large to very large; skin pale green, becoming yellowish-green at maturity, with thin white bloom. Pulp moderately tough, sweet, with considerable foxiness in both odor and taste. It is not a first-rate grape, but moderately good. Vine hardy, foliage large and healthy. Ripening with, or a little before, the Concord. A handsome grape, which seems to be gaining friends with age.

Salem (*Rogers' No.* 53).—Bunch medium to large, loose, usually shouldered. Berries large, round, skin thick and tough, dark red; pulp tough, with some sweet and sprightly juice. A few years ago this variety was planted quite extensively in some of the vineyards along the southern shore of Lake Erie, for wine making, as well as market, but I am inclined to think its popularity is on the wane, for I have rarely seen it in market of late years.

Walter (*A. J. Caywood*).—A cross between Delaware and Iona. Bunch medium, compact, shouldered. Berries medium, light red; pulp tender, sweet, excellent quality. A very handsome and excellent grape, but the vine is feeble, and subject to mildew. It is not an improvement upon either of its parents, although distinct, and in some localities may be considered of more value for wine than as a dessert grape.

Wilder (*Rogers' No.* 4).—Bunch very, large, compact, shouldered. Berry large, round; skin thin, black, liable to crack; pulp tender, with a sprightly flavor. Ripens with Concord, and is a good keeper. Vine very vigorous and hardy, and, unless close pruned, is likely to over-bear and the bunches and berries fail to reach their normal size. A good market grape.

Winchell.—See Green Mountain.

Worden (*S. Worden*).—Seedling of Concord. Bunch large, compact, not uniformly shouldered. Berry large to very large; skin thin, black, with bloom; pulp tender, moderately sweet, very much like its parent in flavor and quality. Ripens five to ten days earlier than Concord. Vine hardy, healthy and productive, and where best known it is considered equal, if not superior, to the Concord as a shipping grape.

Wyoming Red (*Dr. J. S. Parker*). — Bunch small, compact. Berries medium; skin bright, coppery red, thick and tough; pulp sweet, with considerable foxiness, but agreeable to most palates. Very early, and the vine so hardy, healthy and prolific, that this grape may be recommended for all localities where the better varieties fail.

CHAPTER XXII.

NEW, OR LITTLE KNOWN VARIETIES.

Some of the following named varieties may have been known and cultivated in circumscribed localities, such as the grounds of the originator, and those of his neighbors, for a number of years, but this kind of cultivation and dissemination does not afford the general public an opportunity of testing and becoming acquainted with their merits. In many instances those who produce new varieties hold on to the stock for years, merely exhibiting the fruit at fairs and meetings of pomological and kindred societies for the purpose of obtaining prizes and a certain amount of free advertising of the vines, which they expect to offer for sale at some future time. This is all right, in a business point of view; at least, in the opinion of those who practice it; but it is sometimes rather discouraging to those who are seeking only for facts to be placed on record, where others, seeking information of this kind, may readily find it.

A large number of hybrids and cross-bred varieties raised by Mr. T. V. Munson, Denison, Tex., are named in this list; and while it may be said in a general way that many of them promise well, still their value, for either local or general cultivation, is yet to be determined. The names of several other prominent hybridizers and originators of new varieties are also given, with brief descriptions of some of their productions, but if experience counts for anything in grape culture we cannot suppose, nor is it at all likely, that more than one out of every ten of the one hundred and sixty varieties named in the following list will ever become extensively cultivated or known in the markets of our larger cities. There certainly cannot be any good reason (beyond that of pleasing the originator) for describing and recording the names of several dozen white seedlings of Concord and Delaware, and an equal or greater number of reds and blacks of the same or similar parentage, when it would puzzle the most skillful expert to select, by the fruit alone, a half dozen really distinct varieties from among them. If all are equally good and valuable, we gain nothing by multiplying names, beyond nourishing our vanity and increasing the size of nurserymen's catalogues.

Alice (Hyb.).—W. H. Lightfoot, Springfield, Ill. A seedling of Lady Washington, and quite similar to its parent.

Alma (Hyb.).—J. H. Ricketts. Black, early. Sparingly cultivated.

Alphonso.—T. Huber, Illinois City, Ill. A white grape, and said to be a seedling of Concord.

Amber.—J. Rommel, Morrison, Mo. A large amber-colored grape, with oval-shaped berries.

Amber Queen.—N. B. White, Norwood, Mass. Large, dark amber color, and said to ripen early.

America (Hyb.).—T. V. Munson. Large, black, a cross between Post Oak and Rupestris.

Annie M.—A chance seedling from Tennessee, with greenish-white fruit, and claimed to be earlier than Concord.

August Giant (Hyb.).—N. B. White, Norwood, Mass. Supposed to be a hybrid between Marion and Black Hamburg. Fruit large and of a purplish color. It is doubtful if a variety of such a parentage will prove to be of any value for open-air cultivation.

Bailey (Hyb.).—Munson. Fruit black, claimed to be valuable as a wine grape.

Beacon (Hyb.).—Munson. Berries large, and of a red color.

Bay State.—Origin unknown, or kept secret; said to be a hybrid. Berries red.

Beagle (Hyb.). — Munson. Bunch and berry small, or medium; skin thick and black.

Berckmans (Hyb.).—Raised by the late Dr. A. P. Wylie, Chester, S. C. Described as of medium size, and of a pale red color. Dr. Wylie raised a large number of seedlings, mainly from foreign varieties, several of which I tested a few years ago, but found none worth cultivating here, although they may have proved valuable in the South.

Berlin.—Raised by Geo. Hosford, Ionia, Mich. A seedling of Concord, with large greenish-white berries, ripening about the same time as its parent.

Bertha.—A small white grape from Illinois, of which little is known.

Bertrand.—Originated with Hon. J. B. Jones, Henderson, Ga. A bluish-black grape of medium size, very sweet, with a kind of elderberry flavor. Probably valuable for the South.

Big Extra (Hyb.).—Munson. Large, black, with tender red pulp.

Big Hope.—Same origin as the last, but berries only of medium size.

Black Delaware.—Jacob Rommel, Missouri. Said to be similar to its parent, except in color.

Black Herbemont.—Munson. Seedling of the old Herbemont, and much like it.

Boadicea (Hyb.).—Raised by C. J. Copeley, Stapleton, N. Y., and claimed to be a hybrid between Black Hamburg and Telegraph. It has a decidedly poor parentage for a hardy grape.

Boulevard.—Raised by A. Koeth, of Charlotte, N. Y. From Concord, crossed with Brighton. Fruit greenish-white; ripens early.

Brilliant (Hyb.).—Munson. A cross between Lindley and Delaware. A large, handsome, coppery-red grape of excellent quality, ripening with the Delaware. Believed to be one of the best of the Munson hybrids.

Bundy.—Originated with David Bundy, Colerain, O. A black variety; seedling of the Concord, but ripens much earlier than its parent.

Campbell (Hyb.).—Munson. A seedling of Triumph. Bunches large, but berries only medium, and of a golden yellow color. Ripening before the Delaware.

Canonicus.—Raised by D. S. Marvin, Watertown, N. Y. A small pale green variety, ripening with the Concord.

Carman (Hyb.).—Munson. A hybrid between a variety of the wild Post Oak grape of Texas and the Herbemont. The berries are described as large, dark purple, almost black. In quality similar to Herbemont. Late in ripening.

Cayuga.—D. S. Marvin. A black variety resembling the Isabella, but it is claimed to be earlier and of better quality.

Centennial.—Same origin as the above, but of a yellowish-green color at first, becoming amber when fully mature. Late, or with Concord.

Chautauqua.—Found in the vineyard of T. H.

Barhite, Portland, N. Y. Described as almost identical with Concord, ripening at the same time, but the berries a little larger.

Clover Street, Black (Hyb.).—Jacob Moore. Hybrid between Diana and Black Hamburg. Berries large and black, and of fine quality, but vine tender and unhealthy.

Clover Street, Red.—Same origin as the last, but fruit red.

Colerain.—D. Bundy. A seedling of Concord, but of a greenish-white color, of excellent quality, and ripening early, which seems to be true with nearly all of the white or light colored seedlings of the Concord.

Colorado.—Supposed to have been raised at Canon City, Col., but nothing positive is known of its origin or merits. Probably some old variety under a new name.

Concord Chasselas (Hyb.).—Geo. W. Campbell, Delaware, O. A hybrid between Concord and Chasselas. A light amber-colored fruit, ripening with Concord. A very poor parentage for a grape to be grown in the open air in our Northern States.

Concord Muscat (Hyb.).—Campbell. Of doubtful value.

Concordia.—Dr. J. Stayman. A small black grape, a seedling of Delaware, but ripens much later.

Covert.—Origin unknown, but introduced by N. B. Covert, Ann Arbor, Mich. A greenish-white grape, ripening with Concord.

Delawba.—A cross between the Catawba and Delaware, raised by Dr. L. C. Chisholm, Springfield, Tenn. Said to be intermediate between its two parents in size, flavor and period of ripening.

D'Elboux (Hyb.).—Raised by C. J. Copeley, by crossing Telegraph with Black Hamburg. A large black grape, ripening with Hartford Prolific.

Delgoethe (Hyb.).—Munson. Delaware crossed with Goethe.

Delmar (Hyb.).—Munson. Delaware and Martha.

Denison.—Munson. Seedling of Moore's Early.

Detroit.—T. N. Chase, Detroit, Mich. Very much like Catawba.

Diana Hamburg (Hyb.).—Jacob Moore. This can scarcely be called a new grape, but it is one that does not appear to have made many friends away from home. Too late in ripening, and the vine is tender and subject to mildew.

Dinkel.—Munson. Seedling of Catawba, and, from the description, is not as good as its parent.

Dr. Collier (Hyb.).—Munson. Post Oak crossed with Lindley. Large, dark red.

Dr. Hexamer (Hyb.).—Munson. Post Oak and Triumph. Large, black.

Dr. Wiley.—Origin unknown. Named by Judge Samuel Miller. Large, dark red. Vine healthy and hardy.

Early Dawn (Hyb.).—Raised by Dr. Wm. A. M. Culbert, Newburgh, N. Y. A black grape, and said to be a hybrid between Black Hamburg and Isabella. It is barely possible, but scarcely probable, that a valuable variety could be produced from such parents.

Early Ohio.—A chance seedling found in the grounds of N. A. Hunt, Euclid, O. A medium-sized black grape, highly extolled by those who are interested in selling the vines.

Eclipse.—Another chance seedling, parentage unknown. Fruit greenish-white, ripens with Concord.

Early Victor.—Same origin as the above, but fruit black; ripening early, or with Hartford. Introduced by Mr. John Burr, of Leavenworth, Kan.

Edmiston.—Originated with D. G. Edmiston, Adrian, Mich. Seedling of Concord, and resembles its parent, but described as having a tough skin, and ripening a few days earlier.

Elaine.—Seedling of Salem, and introduced by C. Engle, of Paw Paw, Mich. Red, or color of its parent.

Elvibach (Hyb.).—Munson. Medium black, with heavy bloom.

Elvicand (Hyb.).—Munson. A cross of the Elvira and wild Mustang grape of Texas. Dark red.

Elvira.—A seedling of Taylor, raised by Jacob Rommel, Missouri. Only valuable for white wine.

Exquisite (Hyb.).—A seedling of Delaware, raised by Dr. Stayman, and described as resembling its parent in size, color and quality, but vine very healthy and vigorous.

Fena.—Raised by Ludwig Hencke, Collinsville, Ill. Seedling of Jewell; black.

Fern Munson (Hyb.).—Munson. Parents, Post Oak and Triumph; fruit red.

Gilt Edge.—A seedling of Delaware, raised by Dr. Chisholm. Berry cream color, or buff; said to have a banana flavor.

Gold Coin (Hyb.).—Munson. Martha and Cynthiana. Berries medium, and of a dull greenish-yellow color.

Gold Dust (Hyb.).—Munson. Not yet described.

Golden Berry.—Seedling of Hartford. Raised by Dr. Culbert, Newburgh, N. Y.

Golden Drop.—Raised by. C. G. Pringle, East Charlotte, Vt. Supposed to be a cross between Delaware and Adirondac. Small, yellowish-white.

Gov. Ross (Hyb.).—Munson. Large, yellow, conical berries, with tough skin.

Guinevra.—Raised by C. Engle, from seed of the Salem. Very long, compact bunches, with whitish-colored berries. Said to be better than Niagara.

Harrison.—Raised by Isaac Staples, Dayton, O. Supposed to be a seedling of Concord. Fruit medium size, red, and fine flavor.

Hattie.—A chance seedling found by J. A. Putnam, Fredonia, N. Y. Resembles Concord, but claimed to be better in quality, and ripening much earlier.

Herman Jaegar (Hyb.).—Munson. Parentage a wild Texas grape and Herbemont. Berry medium, dark purple; may prove a valuable grape for the South.

Honey.—C. Engle. Seedling of Salem. Bunch medium; berry large, white, and very sweet.

Hopecon.—D. S. Marvin. Bunch and berry medium; pale green, rather late in ripening.

Hosford.—Parentage unknown, but raised by Geo. Hosford, Ionia, Mich. Bunch and berry large; color blue-black, and ripens a few days earlier than Concord.

Husmann (Hyb.).—Munson. A large black grape of excellent quality, ripening a week later than Concord.

Ideal.—Raised by John Burr, from seed of Delaware. Said to resemble its parent, but larger, and ripens later, or about with Concord.

Jaeger's Seedlings.—A large number of varieties raised by Mr. Herman Jaeger, Neosho, Mo., are now on trial in the grounds of the originator, who deserves much credit for thoroughly testing before naming and distributing them.

Jewell.—John Burr. A medium black grape of excellent quality, ripening early. Supposed to be a seedling of Delaware. It has an excellent reputation in Kansas, where it originated.

Jumbo.—Origin unknown, but introduced by Mrs. R. Rose, of Marlboro, N. Y. Bunch and berry very large, blue-black with fine bloom. Ripens a little earlier than Concord. A very handsome and promising grape.

Juno (Hyb.).—Campbell. A large and handsome black grape, unfit for vineyard culture, but may succeed with and please amateurs, who have sheltered gardens.

Keystone.—Origin unknown, but found in the grounds of John Kready, near Mt. Joy, Pa. Resembles Concord, but the skin being tougher, it is a better keeper.

Laughlin.—A chance seedling found by W. R. Laughlin, College Springs, Iowa. Bunch and berry medium; color light green or white. Probably another albino from the Concord.

Leader.—Raised by B. F. Merriman, and is very near or much like Niagara.

Leavenworth.—Another white seedling from Concord, raised at Leavenworth, Kan.

Lightfoot.—Seedling of Niagara, raised by W. H. Lightfoot, Springfield, Ill. Described as similar to its parent, with a tougher skin, and no foxiness.

Linilva.—Munson. A cross between Lindley and Elvira.

Linherb (Hyb.).—Munson. A cross, or hybrid, between Herbemont and Lindley.

Linmar.—Munson. A cross between Martha and Lindley.

Louise.—Roenbeck's. Large white, claimed to be a good table grape.

Lucile.—J. A. Putnam, Fredonia, N. Y. Seedling of Wyoming Red, and claimed to be larger and better than its parent.

Mabel.—A. J. Caywood. Seedling of Walter, but black; not large enough to be useful for market.

Madeline.—A large greenish-white grape raised by G. Henderson, Eddyville, N. Y.

Magee.—Origin unknown; introduced by J. E. Anthony, Watkins, N. Y. Described as a bronzy green with a purplish tinge.

Magnate.—Seedling of Concord, raised in Kansas, and, as usual with such seedlings, of better quality than its parent.

Mansfield.—Pringle. Seedling of Concord, and, from description, it must be very much like its parent.

Marguerite (Hyb.).—Munson. Post Oak and Herbemont. Medium, and of a purple color.

Marguerite.—Another white seedling of Concord, raised by T. Hubert, Illinois City, Ill.

Marie Louise.—Same origin as the last, and similar in color.

Mary Mark.—Dr. Stayman. Medium, red; supposed to be seedling of Delaware.

Mary's Favorite.—J. F. Coffin, Westland, Ind. A small black grape with bluish bloom. Ripens late.

Mason.—Raised by Mr. B. Mason, Mascoutah, Ill. White; seedling of Concord, ripening at the same season.

Matchless.—Origin unknown, but introduced by John Burr. Large, black, of good quality, ripening early.

Mathilde.—G. A. Ensengberger, Bloomington, Ill. Large, dark red.

Mendota.—John Burr. Medium, black; said to keep well.

Michigan.—E. Engle. A seedling of Salem, but of a greenish-white color.

Mills (Hyb.).—Large, black, and a hybrid between Black Hamburg and Creveling. Raised by Wm. H. Mills, of Hamilton, Ont. Ripens late, and is a good keeper.

Mineola (Hyb.).—C. J. Copely. A large white grape, claimed to be a hybrid between Telegraph and Chasselas Musque.

Missouri Riesling.—A small, late, pale red grape, valuable for wine in Missouri.

Monroe.—Raised by Ellwanger & Barry, Rochester, N. Y. Supposed to be a cross between Delaware and Concord. An early, medium sized black grape, very near Hartford Prolific.

Mrs. Munson.—Munson. A purple grape, raised by crossing Neosho with Herbemont. It cannot possibly be of any value in the North.

Mrs. Stayman.—Dr. Stayman. Seedling of Delaware, of same color, but bunch and berry larger, or nearer Catawba in size and season of ripening.

Muench.—Munson. Another cross between Neosho and Herbemont. It may succeed in the South.

Nectar.—Caywood. Said to be a cross between Concord and Delaware. Black, of medium size, and of excellent quality.

Neva Munson.—Munson. A cross between Neosho and Herbemont. Berries large, black.

Nina.—Raised by C. H. Woodruff, Ann Arbor, Mich. Seedling of Diana, and similar in size and color, but said to ripen earlier than its parent.

Norwood.—Introduced by T. B. White, Norwood, Mass. Described as resembling Concord, but clusters and berries a little larger, and ripening somewhat earlier.

Obed.—A chance seedling found in Illinois. Berry and bunch medium; greenish-white with delicate bloom.

Omega.—J. Burr. A very large red grape, described as of excellent quality, and the vine hardy and prolific in the West.

Onderdonk.—Munson. A large bunch, but small white berries. It may be worth cultivation in the South.

Oneida.—Seedling of Agawam (Rogers' No. 15). Similar in size and color, but claimed to be a better grape.

Opal.—Munson. Bunch medium. Berries described as large, and of a yellowish color. Seedling of Lindley.

Oriole (Hyb.).—Munson. Small, black; vine tender. Recommended only for the South.

Orphan Boy.—Supposed to be a cross between Delaware and Wilder, but as described, it is very much like Concord.

Osceola.—Dr. J. Stayman. A large white grape; said to ripen early.

Oskaloosa.—Dr. Stayman. Medium size, black. Supposed to be a seedling of Delaware.

Ozark.—Dr. Stayman. A very large black grape of unknown parentage.

Paragon.—John Burr. A large black grape, ripening with Concord, but claimed to be of better quality.

Paragon (Hyb.).—C. J. Copely. A large purple grape, and a hybrid between Black Hamburg and Telegraph. It may thrive in protected gardens, but scarcely in the open vineyard.

Pearl.—J. Rommel. Bunch and berry medium; pale yellowish white; vine described as hardy and productive in Missouri.

Peola.—John Burr. A black grape of medium size, and claimed to be a fine dessert fruit in Kansas.

Perfection.—Dr. Stayman. Said to be a seedling of Delaware, but larger. The originator claims that it is the best red grape in Kansas.

Perry (Hyb.).—Munson. A small purple grape; for the South only.

Pierce.—Claimed to be a sport of the Isabella, found on a vine in the grounds of J. P. Pierce, Santa Clara, Cal. The berries and bunches much larger than Isabella, and berries round instead of oval, as on the parent vine. Such sports are not uncommon in all vineyards, but they are seldom noticed and preserved.

Prairie State.—A white grape, said to be a seedling of Martha, and better than its parent. Raised by J. Christian, Mount Carroll, Ill.

Primate.—A late red grape, introduced by John Burr. Very much like Catawba.

Prof. Hilyard (Hyb.).—Munson. Post Oak and Herbemont. Medium, purple.

Profitable (Hyb.).—Munson. Large, pale red; berry slightly oblong.

Pulpless.—C. Engle.—Large, oval, black; ripens with Concord.

Purity.—Campbell. Medium, white, and claimed to be better than Delaware, and a strong, healthy grower.

Reagan (Hyb.).—Munson. Large clusters, with medium size black berries.

Red Bird.—Munson. A cross between Champion and Lindley. Dark red.

Red Eagle. (Hyb.).—Munson. Seedling of Black Eagle; dark red.

Reliance.—J. G. Burrows, Fishkill, N. Y. A cross between Delaware and Iona. Described as a vigorous grower, with large, healthy foliage. Fruit resembles Delaware, but larger.

Rochester.—Ellwanger & Barry; parentage unknown. Large bunch, medium berry, black. Very productive, and the fruit excellent as grown at Rochester.

Rockland Favorite.—Ellwanger & Barry. Seedling of Concord, and very much like it.

Roenbeck.—Found in the grounds of Jas. W. Trask, Bergen, N. J.; origin unknown. Fruit pale green, and of medium size.

Rommel (Hyb.).—Munson. A medium size berry and large clusters. Yellowish white, and it is thought that the vine will prove hardy in the North.

Roswither.—L. Hencke, Collinsville, Ill. A dark purplish grape of medium size, ripening before the Concord.

Rotent.—Seedling of Pocklington, and closely resembling its parent. Raised by C. F. Rotent, Put-in-Bay, O.

Superb.—Southern origin, and said to be a seedling of Eumelan, and of the same color (black). Raised by A. F. Rice, Griswoldville, Ga.

Superior.—John Burr. Seedling of Jewell. Black.

Supreme.—John Burr. Same origin as the last, and same color.

Triumph (Hyb.).—Campbell. A hybrid between

Concord and Chasselas Musque. Large, white, said to succeed well in the South.

Ulster Prolific.—A. J. Caywood. Bunch and berry medium, red, sweet; ripens with Concord. Vine hardy and prolific.

Undine.—Ricketts. A large, pale green grape, recommended for the South only.

Vergennes.—Introduced by Wm. E. Green, Vergennes, Vt. A large red grape, with medium size bunch; rarely with shoulder. Skin very thick and firm; pulp sweet and juicy. Will probably become a profitable market grape.

Vinita. (Hyb.).—Munson. Same parentage as the Perry. Small, purple.

Watertown.—D. S. Marvin. Medium, greenish-white; sweet and good.

Wells.—C. I. Roberts, Butler, Mo. Described as a large, dark wine-colored fruit, adhering to the bunch long after it is fully ripe. A little later than Concord.

White Ann Arbor.—This is another of the many hundred white grapes raised from Concord seed, ripening earlier than its parent.

White Beauty.—A seedling of Duchess, of same color, but said to be healthy and prolific in Kansas. Raised by Dr. Stayman.

White Cloud.—Same origin as the last, and of same color.

White Imperial.—This is another seedling of Duchess raised by Dr. Stayman, and much prized by the originator for its good quality, and productiveness of the vine.

White Jewell.—Seedling of Elvira, by Dr. Stayman, and claimed to be very early, and one of the best white grapes in Kansas.

Witt.—Seedling of Concord; large, white, and described as one of the very best of its kind.

Woodbury White.—Introduced by David B. Woodbury, Paris, Me. In growth of vine it is said to resemble the Delaware, but berries are white, and as large as those of the Concord

CHAPTER XXIII.

OLD, OBSOLETE, AND INFERIOR VARIETIES.

As the new varieties are introduced and become known, the inferior among the older ones are very likely to be crowded out of cultivation, although an occasional vine may remain in old gardens, or be retained in vineyards for the purpose of comparison with the newer productions. Many such old acquaintances, and perhaps some local favorites, will be found in the following list, and a few of these are still growing in my own grounds, as relics of more than one hundred similar varieties long since cremated. There are also a number of varieties named in this list which may be considered of some value for wine, and they will be noted, but as this work is not intended as "a wine-maker's manual," I have paid very little attention to grapes recommended only for wine. I have also purposely placed here many varieties which are not sufficiently distinct to make them worthy of preservation, except in the grounds of those who pride themselves upon the number of names recorded in their private or published lists of grapes. If a man has almost any four of Rogers' hybrids in cultivation, he possesses all that is specially valuable in the twenty or more originally disseminated, and this is equally true of several other collections which have been distributed in years past as well as those likely to be, in years to come.

Adelaide.—Ricketts. Hybrid, black; vine unhealthy.

Adeline.—Miner. White; obsolete.

Adirondac.—Proved to be Isabella.

Advance.—Ricketts. Hybrid, black; worthless.

Aiken.—Seedling of Isabella; now lost.

Albert.—Huber. Black; too near Concord.

Albino.—J. B. Garber. White; now obsolete.

Aledo.—B. F. Stringer. Greenish-white; poor quality.

Alexander.—Old wild, black, fox grape.

Allair.—Large, red, wild, fox grape.

Alnez or Hagar.—Small, black; worthless.

Amanda.—Black, wild, fox grape.

Aminia.—Rogers' No. 39; not sufficiently distinct from Barry.

Andover.—Black fox; worthless.

Anna.—Hasbrouch. Late white; no value.

Archer.—White; too late for the North.

Ariadne.—Ricketts. Small, black; worthless.

Arkansas.—Southern. Doubtful if it can now be identified.

Arnold's Hybrids.—Raised by the late Chas. Arnold, Paris, Ont. Introduced some thirty years ago under various names; but all are worthless here in the Northern States.

Arrot.—White; and too near like Cassidy.

Aughwick.—Small, late, black; very acid.

August Pioneer.—An old, black, fox grape.

Autuchen.—Arnold. Greenish-white; vine tender.

Baldwin's Lenoir.—Black; no special value.

Barnes.—An old, black grape; out of cultivation.

Baroness.—Similar to Moore's Early.

Baxter.—Black, very acid; worthless.

Belinda.—Miner. Not distinct from Ida.

Belvidere.—Too much like Hartford.

Benjamin.—Resembles and ripens with Concord.

Berks or Lehigh.—Only a Catawba.

Bird's Egg.—White or spotted; doubtful.

Black Defiance.—S. W. Underhill. Of no special value.

Black Eagle.—Same origin as the last, and worthless.

Black Hawk.—Probably out of cultivation.

Black Imperial.—An old, black, fox grape; but this name has recently been appropriated by Dr. Stayman for one of his new varieties.

Black King.—From Pa.; is Clinton.

Black Maderia.—See Alexander.

Blackstone.—An early, black, fox grape; worthless.

Black Taylor.—May be valuable in the South, but very doubtful.

Bland.—Southern. Small, pale green; obsolete, and the same is true of several other varieties which Col. Bland introduced many years ago.

Blood's Black.—And Blood's white. Both wild, fox grapes; of no value.

Blue Favorite.—Southern. Said to be a good wine grape.

Boadicea.—Miner. Doubtful if now known.

Bottsi.—Southern. Probably Herbemont.

Brackett's Seedling.—Proved to be Isabella.

Brandywine.—A white grape; a seedling of some foreign variety.

Brinckle.—Raised by Peter Raabe. A seedling of foreign; black and worthless.

Brown.—Too much like its parent, the Isabella.

Burroughs.—Too much like the Clinton.

Burton's Early.—Wild, fox grape.

Cambridge.—Not distinct from Concord.

Camden.—A white fox grape of no value.

Canada.—One of Arnold's hybrids; not valuable.

Canada Wine.—A wild frost grape; no value.

Canby's August.—Black; worthless.

Carlotta.—Miner. White; like Augusta.

Carter.—Black, and a slight advance upon the wild grape.

Carpenter.—A supposed hybrid, now obsolete.

Catawissa.—See Creveling.

Charlotte.—Resembles Diana; probably lost.

Charter Oak.—Large, worthless, fox grape.

Chippewa.—Named but not disseminated; black.

Christina.—A large, black, fox grape; obsolete.

Clara.—A seedling of Vinifera; white, no value.

Claret.—The grape known to me under this name is much like Clinton, but there is said to be another of a claret color, but of no value.

Clarke.—A red grape from Washington, D. C.; of no special value.

Clinton.—Old and well known frost grape; sometimes cultivated in the North for wine.

Cloantha.—Black; seedling of Isabella, but more foxy.

Cornucopia.—Arnold. Black, acid; worthless.

Cotoctin.—An old, white grape, now unknown.

Cowan.—Very old; black, obsolete.

Creveling.—Old, black grape; probably obsolete.

Croton.—A white, hybrid variety raised by S. W. Underhill, but the vine is tender and subject to mildew; no value.

Cunningham.—Small, blue-black; valuable for wine in the South.

Cuyahoga.—A white grape from Ohio, which has been superseded by larger and better varieties.

Don Juan.—Ricketts. Large, dark red, probably not disseminated.

Dorinda.—Seedling of Rebecca, and worthless.

Dorr Seedling.—Seedling of Delaware; discarded.

Downing.—Ricketts. A cross between two foreign varieties, and worthless for vineyard culture.

Dracut Amber.—Wild, red; fox, or seedling therefrom.

Dunn.—From Texas; of the Herbermont type; tender in the North.

Early Dawn.—Black; early, but the vine is very feeble.

Eldorado.—Ricketts. Vine subject to disease and not very hardy.

Elsingburg.—Very small, late, black; of little value.

Essex.—Rogers' No. 41. Rarely cultivated.

Eugenia.—Miner. Very much like Augusta.

Eumelan.—Medium black; vine unhealthy, but is said to thrive in the South.

Eureka.—W. R. Prince. Proved to be Diana.

Eureka.—D. H. Bogue. Very like Isabella.

Ewing.—From Missouri; too near Isabella.

Faith.—Early white; excellent in Missouri.

Fancher.—T. B. Fancher. The old Catawba.

Fisk.—J. T. Allen, Salem, Mass. Rejected.

Florence.—Said to resemble Hartford, but inferior.

Flowers.—One of the many local names of the wild Scuppernong grape of the South.

Framingham.—Synonym of Hartford Prolific.

Franklin.—Miner. Black seedling of Concord, but inferior to its parent.

Gærtner.—Rogers. Red; doubtful if now to be found in cultivation.

Garnet.—Dr. Wylie. Of no value in the North.

Gazelle.—Ricketts. White; probably lost.

Gerber.—Dr. Wylie. Medium black; of no value.

Golden Clinton.—An old, and worthless variety.

Golden Concord.—White; very much like, but inferior to Martha.

Graham.—Black; probably not in cultivation.

Greins' Golden.—Of little or no value here.

Harrison.—Black; very late, not valuable.

Harwood.—From Texas. May succeed in the South.

Herbert.—Rogers' No. 44. Near to, but no better than Barry and Aminia.

Hermann.—Small, black; a good wine grape in the South.

Herbemont.—An old, and well known wine grape in the South.

Highland.—Ricketts. Large, black; ripens very late.

Imperial.—Ricketts. White; large but late.

Israella.—Dr. C. W. Grant. Medium, black; vine unhealthy.

Irving.—Underhill. Black; vine feeble, worthless.

Irving.—October. Late, wild, red, fox grape.

Ives.—Henry Ives. Very near Hartford Prolific.

Jacques.—Synonym of Lenoir.

James.—A variety of the Scuppernong.

Jennie May.—John Laws. Probably Concord.

Kalamazoo.—Dixon. As described, near Catawba.

Kalista.—J. Sacksteder. Very like Delaware.

Kay's Seedling.—Probably Herbemont.

Kendall.—Very near, if not, Isabella.

Kilmington.—Not now known by this name.

Kingsessing.—Pale red, wild, fox grape.

Kramer's Seedling.—C. Kramer. Probably Concord.

Lacrissa.—Sacksteder. White; seedling of Delaware.

Lady Charlotte.—Pringle. White; scarcely known in cultivation.

Lawrence.—Dr. Fay. Similar, but inferior to Concord.

Lenoir.—Small, blue-black; Southern wine grape.

Lexington.—Miner. Black; not in cultivation.

Lincoln.—Small, black; Southern wine grape.

Linden.—Miner. Medium, black; worthless.

Lindley.—Rogers' No. 9. Large, red; said to be a fine grape in the South.

Logan.—An old, black grape, of no value.

Lorain.—Similar to above; never disseminated.

Louisiana.—Southern wine grape.

Luna.—Too near Martha, if not identical.

Lutie.—Seedling of wild, red, fox grape.

Lydia.—Chas. Carpenter. White; of little value.

Lyman.—Small, black; much like Clinton.

Lyons.—Red, and very near Catawba.

Manhattan.—Medium size, wild, white, fox grape.

Mammoth Sage.—Large, red, fox grape.

Marsala.—A red fox grape of little value.

Marion.—An old, black variety; obsolete.

Mary Ann.—J. B. Garber. Black; now unknown.

Mary.—Carpenter. White; long since discarded.

Mary Wylie.—Dr. Wylie. Worthless except in the South.

Massasoit.—Rogers' No. 3. Too near Salem and Lindley, but neither worse nor better.

Maxatawney.—Small, pale yellow, and worthless.

Maclure.—Peter Wylie. Small, white; of no special value.

Meade's Seedling.—Synonym of Catawba.

Medora.—Small, white; may succeed in the South.

Merrimac.—Rogers' No. 19. Too much like Wilder, or Rogers' No. 4.

Metternich.—Caywood. Small, black; vine unhealthy.

Minnehaha.—Seedling of some foreign variety.

Mottled.—Carpenter. Long since discarded.

Naomi.—Ricketts. Large, pale red; vine unhealthy.

Nebraska.—Wilding. See page 104.

Neosha.—Wilding. From Missouri; good for wine.

Neverfail.—Black, and very late.

Newark.—Medium black; subject to rot and mildew.

Newburg.—Ricketts. Of doubtful value.

New Haven.—Too near Concord to be retained.

Noah.—Small, greenish-white; of no special value.

Nonantum.—Francis Dana. Very like Isabella.

North America.—Wild, black, fox grape.

North Carolina.—Very close to Isabella.

Northern Muscadine.—Wild, red, fox grape.

Norton's Virginia.—Southern. Sparingly cultivated for wine.

Oberon.—Campbell. Black; vine tender.

Ohio.—Red; and probably now unknown.

Old Ford.—A wild, red grape from N. C.

Onondaga.—Very close to Delaware.

Ontario.—Same as Union Village.

Oporto.—Old, and worthless native variety.

Oriental.—Not sufficiently distinct to be preserved.

Osage.—Origin and merits in doubt.

Osee.—White; recommended for wine only.

Othello.—Arnals' Hybrid. Black; very late

Pauline.—Similar to Lenoir and Lincoln.

Pauline.—Miner. Similar to Antoinette; white.

Peabody.—Ricketts' Hybrid. May be valuable South.

Pearson's Ironclad.—A. W. Pearson. Excellent for wine.

Perkins.—Old, red, fox grape; worthless.

Peter Wylie.—Dr. Wylie. Small, white; foreign parentage, succeeds best in the South.

Pizzaro.—Ricketts. Recommended for red wine.

Pollock.—Purplish black; seedling of foreign species, and worthless.

Progress.—Much like Catawba, but not as good.

Putnam.—Ricketts. Of this variety little is known.

Quassaic.—Ricketts. Of doubtful value.

Raabe.—Peter Raabe. Small, red; worthless.

Racine.—Small, black; Southern; unproductive.

Rariton.—Ricketts. Recommended for wine only.

Rachel.—Small, white; probably obsolete.

Rebecca.—E. M. Peake. White; vine unhealthy.

Red Shepherd.—Small, red; discarded.

Rentz.—S. Rentz. Large, black; rejected.

Requa.—Rogers' No. 28. Red; unreliable.

Rockinham.—Miner. Medium, black; worthless.

Rockwood.—E. W. Bull. Inferior to Concord.

Rulander.—A Southern wine grape.

Sanasqua.—Underhill. Purplish-black; unreliable.

Saratoga.—Proved to be Catawba.

Secretary.—Ricketts. Large, black, acid; scarcely edible, and vine unhealthy.

Selma.—Black; recommended for red wine.

Seneca.—Seedling of Hartford, and of no value.

Sharon.—Too much like Isabella.

St. Catharine.—J. W. Clark. Seedling of wild, red, fox grape, and of no value.

Storm King.—E. P. Roe. Very near if not identical with Concord.

Taylor.—Small, white, and worthless.

Telegraph.—An old, early, black grape; near Hartford.

Theodosia.—E. S. Salisbury. Small, black; like Clinton.

Thomas.—A variety of the Scuppernong. Valuable in the South.

To Kalon.—Large, purplish black; long since discarded.

Transparent.—Seedling of Taylor; for wine only.

Uhland.—Greenish-yellow, similar to Taylor.

Underhill.—Dr. A. K. Underhill. Wild, red, fox grape.

Union Village.—Late, black; of no special value.

Urbana.—Seedling of Concord; yellowish-white, late.

Venongo.—An old, red, fox grape; long since discarded.

Victoria.—Miner. Very like Antoinette.

Waverly.—Ricketts. Black; very acid and late.

White Catawba.—J. E. Mottier. Long since discarded.

White Delaware.—Of these there are a great number, but I have yet to see one worth cultivating.

Wilmington.—Greenish-white; old and discarded.

Yeddo.—From Japan, and of no value.

York Maderia.—An old, black grape; long since discarded.

Young America.—Miller. Very much like Concord.

CHRONOLOGICAL CATALOGUE

OF

WORKS ON GRAPE CULTURE.

PUBLISHED IN THE UNITED STATES, WITH DATE AND PLACE OF PUBLICATION, AND NAMES OF AUTHORS.

1823.—A Memoir on the Cultivation of the Vine. By John Adlum, Washington, D. C.

1826.—The American Vinedresser's Guide. John James Dufour, Cincinnati, Ohio.

1827.—The American Vinedresser's Guide. Alphonse Loubat, N. Y.

1829.—Vinedresser's Theoretical and Practical Manual. Théabaut de Berneaud (translated from the French), New York.

1830.—American Manual of the Grape Vine. C. S. Rafinesque, Philadelphia.

1830.—Treatise on the Vine. William R. Prince, New York.

1834.—Observations on the European Vine. S. I. Fisher, Philadelphia.

1837.—Practical Treatise on the Cultivation of the Grape Vine. Clement Hoare (reprint from the English edition), Boston.

1846.—Cultivation of American Grape Vines. Alden Spooner, Brooklyn, N. Y.

1848.—Grapes and Wine. James Busby, New York.

1852.—Culture of the Grape. Robert Buchanan, Cincinnati, Ohio.

1852.—American Grape Grower's Guide. William Chorlton, New York.

1853.—The Cold Grapery. William Chorlton, New York.

1853.—A Practical Treatise on the Culture of the Grape Vine. J. Fiske Allen, New York.

1854.—A Rough Sketch of the Renewal System of Pruning Grape Vines. William Martin, Sr., Pittsburg, Pa.

1855.—The Vine; its Culture in the United States. R. H. Phelps, Hartford, Conn.
1856.—A Treatise on the Culture and Management of Grape Vines. James Suydam, Brooklyn, N. Y.
1856.—New Process of the Culture of the Vine. Persoz (translated by J. O'C. Barclay), New York.
1859.—Vinedresser's Manual. Charles Reemelin, New York.
1859.—Grape Culture. H. De Caradeuc, Augusta, Georgia.
1860.—An Essay on Grape Culture. By George Husmann, St. Louis, Mo.
1860.—Both Sides of the Grape Question. William Saunders, Philadelphia.
1860.—Bright on the Grape. William Bright, Philadelphia.
1862.—Open Air Grape Culture. John Phin, New York.
1863.—Our Hardy Grapes. J. M. Knowlton, New York.
1863.—An Essay on the Culture of the Grape. George Husmann, Hermann, Mo.
1863.—Grape Culture and Wine Making. A. Haraszthy, New York.
1864.—The Grape Culturist. A. S. Fuller, New York.
1865.—Grape Culture in Steuben Co. Hon. G. Dennison, Prattsburg, N. Y. Prize Essay for the N. Y. State Agricultural Society.
1866.—The Canada Vine Grower. By J. M. De Courtenay, Toronto.
1866.—My Vineyard at Lakeville. By A Western Grape Grower, New York.
1866.—Grapes and Wine. George Husmann, Hermann, Mo. New York.
1866.—Manual of the Vine. C. W. Grant, Iona, N. Y.
1866.—Essay on Grape Culture and Wine Making. B. D. Reddington, Rockland, Iowa.
1866.—Essay on a New System of Grape Culture. Dr. H. Schroeder, Bloomington, Ill.
1866.—Culture of the Grape. W. C. Strong, Brighton, Mass. Boston.
1867.—Hand Book of Grape Culture. T. Hart Hyatt, San Francisco, Cal.
1867.—The Grape Vine. By Frederick Mohr (translated by Prof. Charles Siedhof), New York.
1867.—Vineyard Culture. By Du Breul, with notes by Dr. John A. Warder, Cincinnati, Ohio.
1867.—An Elementary Treatise on American Grape Culture. By Peter B. Meade, New York.
1867.—The Champagne County. By Robert Tomes, New York.

1868.—The Wine Maker's Manual. By Charles Reemelin, Cincinnati, Ohio.
1868.—Rudiments of Grape Culture. By John R. Eakin, Little Rock, Ark.
1869.—Three seasons in European Vineyards. By Wilson J. Flagg, New York.
1877.—Various Experiments with Grapes. By George Haskell, Ipswich, Mass.
1880.—Report upon Statistics of Grape Culture and Wine Production. By Wm. McMurtie, Ph. D., Department of Agriculture, Washington, D. C.
1881.—First Annual Report of the Board of the State Viticultural Commissioners of California, San Francisco, Cal. The second report of the same, 1882; the third, 1884; and others at intervals down to the present time.
1886.—Report on the Fungus Diseases of the Vine. By Lamson Scribner, Department of Agriculture, Washington, D. C.
1888.—Report on the Experiments made in 1887, in the Treatment of the Downy Mildew and Black Rot of the Grape Vine. B. F. Lamson Scribner, Department of Agriculture, Washington, D. C.
1890.—Classification and Generic Synopsis of the Wild Grapes of North America. By T. V. Munson, Department of Agriculture, Washington, D. C.
1891.—Fungus Diseases of the Grape, and their Treatment. By B. T. Gallaway, U. S. Department of Agriculture, Washington, D. C.
1893.—Our Native Grapes. Grapes and their Culture. Published by C. Mitzky & Co., Rochester, N. Y.
1893.—American Grape Training. By L. H. Bailey, New York.
1893.—Practical Treatise on Grape Culture. By J. H. Tryon, Willoughby, Ohio.

INDEX

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